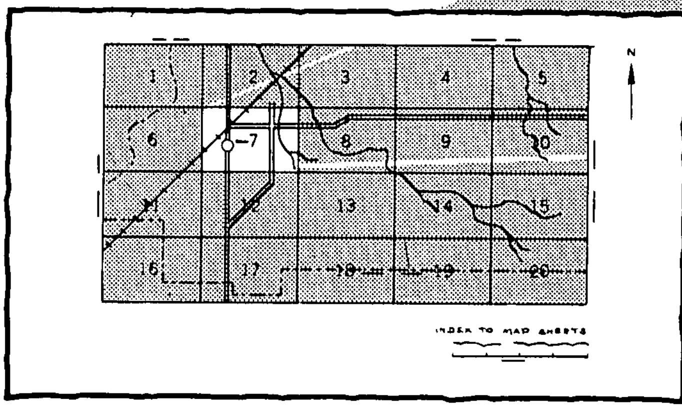
soil survey of

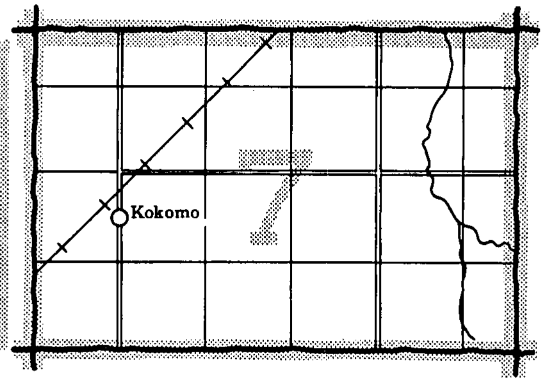
yuma county, colorado

united states department of agriculture,
soil conservation service
in cooperation with
yuma soil conservation district,
yuma county soil conservation district, and
colorado agricultural experiment station

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).





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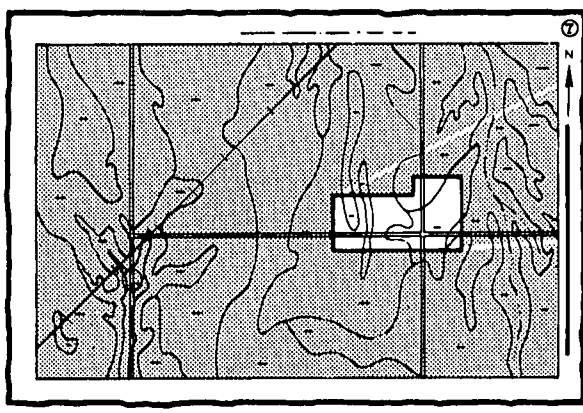

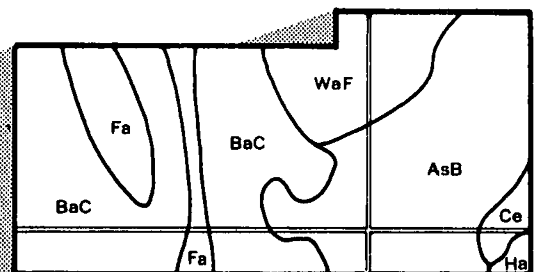

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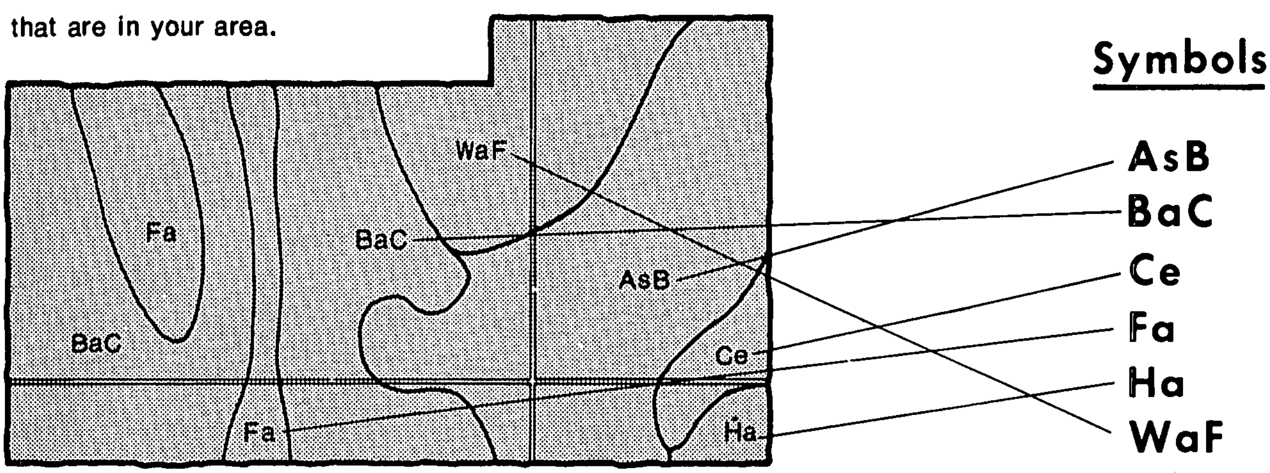
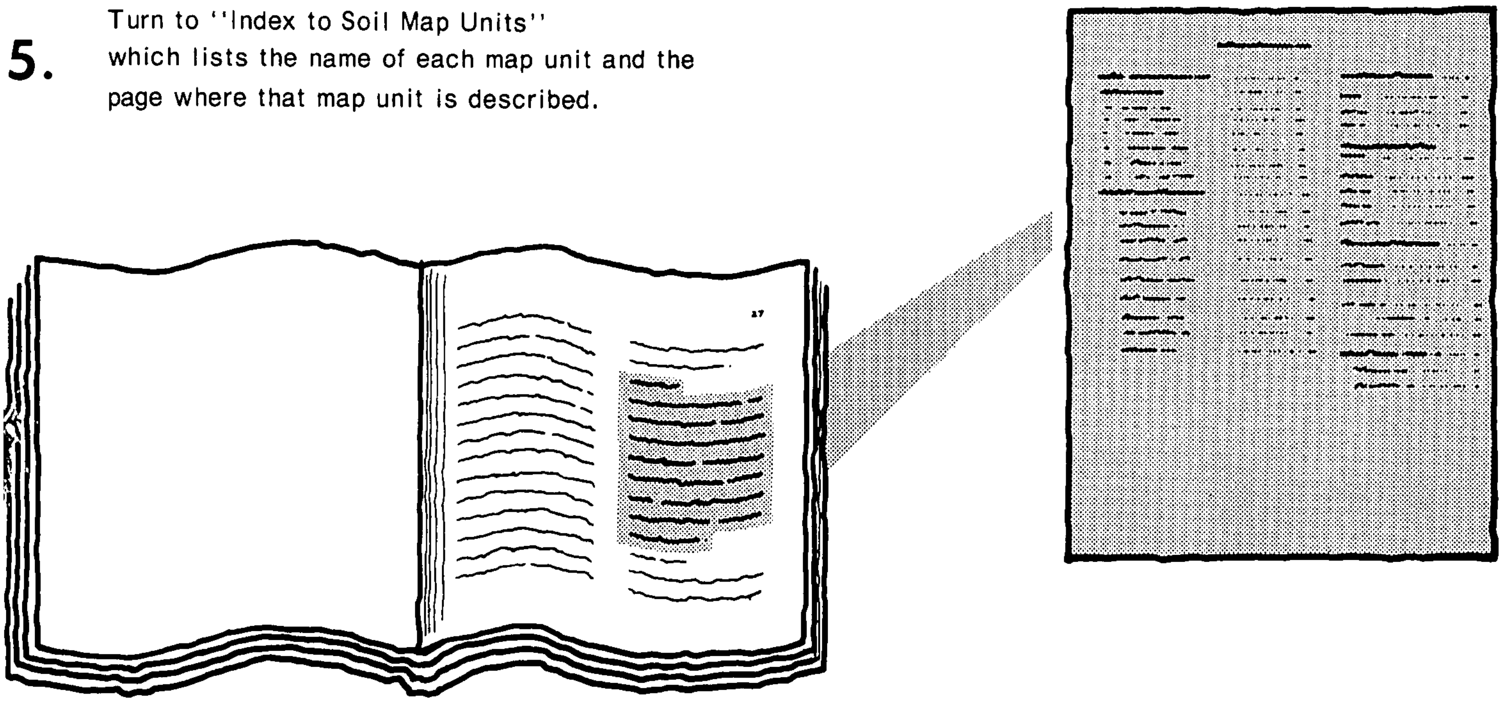
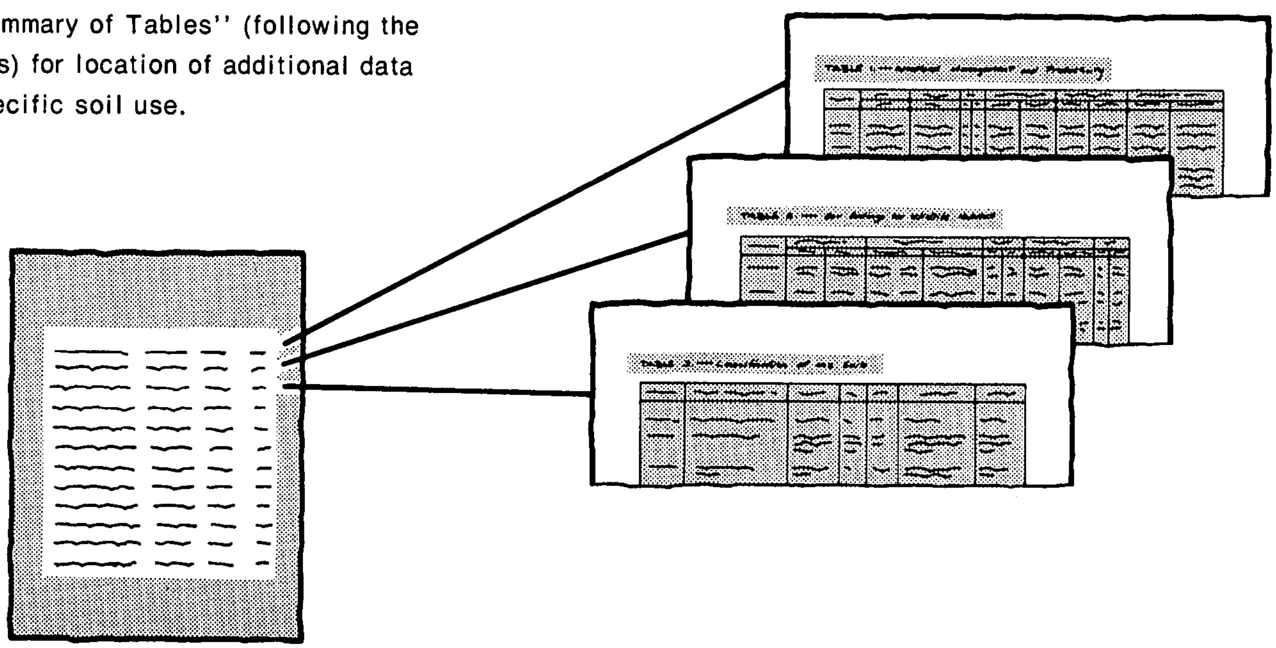


THIS SOIL SURVEY

5. Turn to ''Index to Soil Map Units'' which lists the name of each map unit and the page where that map unit is described.



6. See ''Summary of Tables'' (following the Contents) for location of additional data on a specific soil use.



7. Consult ''Contents'' for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1973 to 1976. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service, the Yuma Soil Conservation District, the Yuma County Soil Conservation District, and the Colorado Agricultural Experiment Station.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: On the nearly level plains of Yuma County, farmstead windbreaks help to protect farm buildings from wind and drifting snow.

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foreword

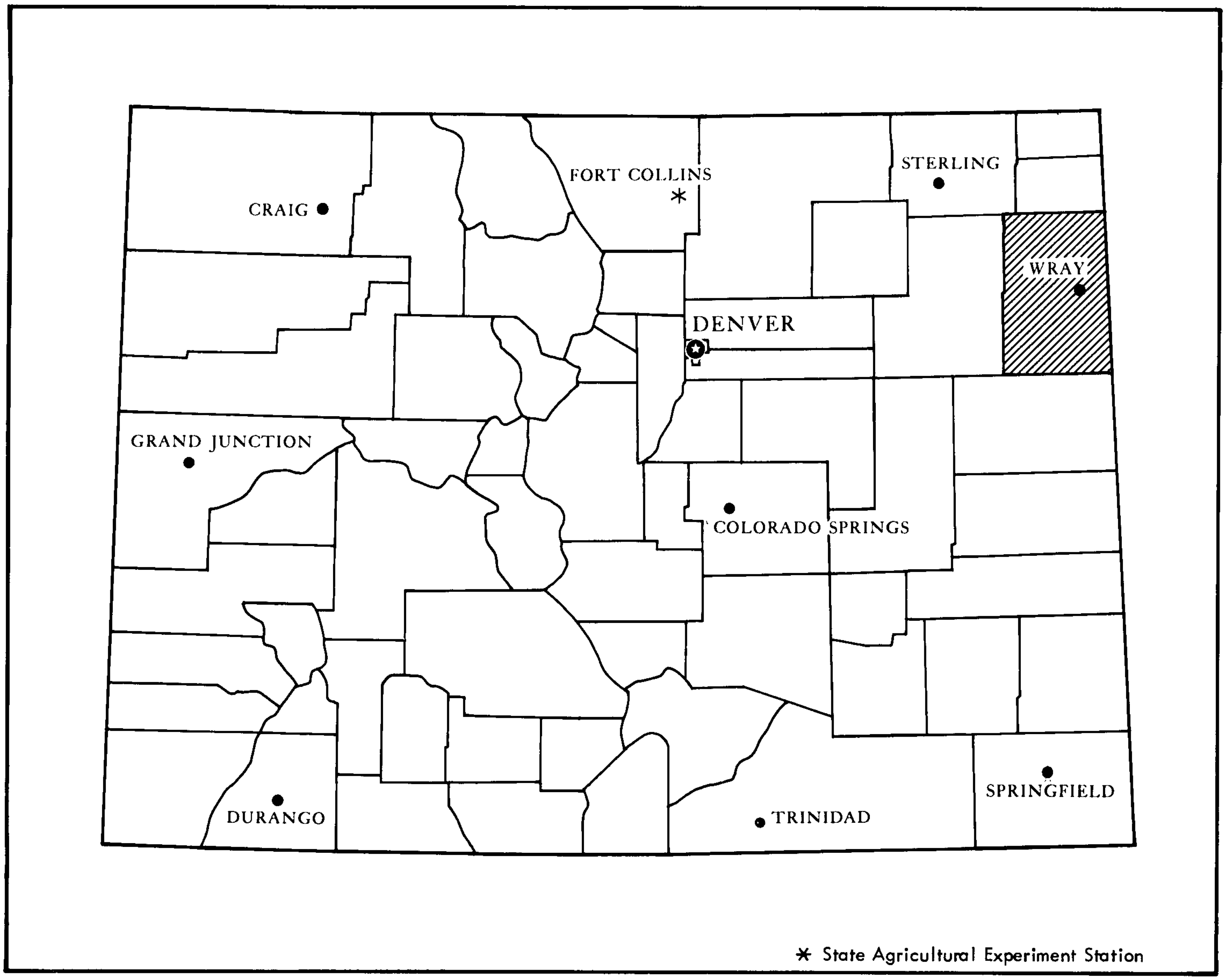
This soil survey contains information that can be used in land-planning programs in Yuma County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert G. Halstead
State Conservationist
Soil Conservation Service



Location of Yuma County in Colorado.

soil survey of
Yuma County, Colorado

By Roy J. Larsen, Soil Conservation Service

Soils surveyed by Roy J. Larsen, Bernard A. Benton, Ralph L. Swift, Louis A. Fletcher, Everett E. Geib, and Alan E. Amen, Soil Conservation Service, and Dennis J. Hahn and Robert C. Accola, Yuma County

United States Department of Agriculture, Soil Conservation Service in cooperation with Yuma Soil Conservation District, Yuma County Soil Conservation District, and Colorado Agricultural Experiment Station

YUMA COUNTY is on the high plains in northeastern Colorado. Wray, the county seat, is in the eastern part of the county. It has a population of 2,100. Yuma, the other main municipality, is in the western part of the county and has a population of 3,200. Yuma County is about 40 miles wide and 60 miles long, and the total area is 1,525,120 acres. The climate is mild, and the average annual precipitation is 17 inches. The average growing season is 143 days. The nearly level hardlands in the northwestern, southern, and southeastern parts of the county are separated by gently rolling to undulating sandhills. The elevation ranges from 3,500 feet on the flood plain of the Republican River in the southeastern part of the county to about 4,150 feet in the northwestern corner.

The land is drained mainly by the North and South Forks of the Republican River and by the Arikaree River. Bonnie Reservoir, in the southeastern part of the county, is about 2,000 acres in size and is a major recreation area.

The economy of Yuma County is based on farming and ranching. In recent years, irrigation has greatly influenced the economy. Ground water is used for irrigation and is applied by center-pivot sprinklers and field ditches. About 40 percent of the acreage in the county is used for nonirrigated and irrigated cropland, meadow, and pasture. Corn, sugar beets, alfalfa, and dry-shelled beans are the major irrigated crops. Winter wheat and grain sorghum are the major nonirrigated crops. The rest of the acreage, about 60 percent, is used mainly for grazing.

The industry in Yuma County also is based on farming and ranching. Grain elevators and feed mills store and process agricultural products. Several companies in the county supply systems for irrigation.

The Chicago, Burlington, and Quincy Railroad passes through Yuma and Wray. Major highways in the county are U.S. 34, 36, and 385 and Colorado 59.

general nature of the county

This section provides general information about the climate; physiography, relief, and drainage; history and development, and natural resources of Yuma County.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Yuma, Wray, and Bonny Lake in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 30 degrees F, and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred at Yuma on December 6, 1972, is -29 degrees. In summer, the average temperature is 73 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Wray on July 11, 1954, is 112 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 16 inches. Of this, 13 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 10 inches. The heaviest 1-day rainfall during the period of record was 3.8 inches at Wray on July 19, 1973. Thunderstorms occur on about 49 days each year, and most occur in summer.

The average seasonal snowfall is 31 inches. At Wray, the greatest snow depth at any one time during the period of record was 35 inches. At Yuma, it was 15 inches. At least 1 inch of snow is on the ground on 8 to 15 days.

The average relative humidity in midafternoon is about 40 percent. Humidity is higher at night. The average humidity at dawn is about 79 percent in summer and 61 percent in winter. The sun shines 70 percent of the time possible in summer and 65 percent in winter. Winds are from the south-southeast. The average windspeed is highest, 14.6 miles per hour, in April.

physiography, relief, and drainage

Yuma County is in the High Plains Section of the Great Plains Province on the broad, irregular plain that slopes from the Rocky Mountains eastward to the Mississippi Valley (*8*).

The soils in Yuma County formed in four principal physiographic areas: (1) upland areas underlain by the Ogallala Formation, (2) upland areas underlain by loess, (3) upland dune sand areas, and (4) valley areas.

Upland areas underlain by the Ogallala Formation are the areas of nearly level plains in the northeastern and southwestern parts of Yuma County. In these areas, the Ogallala Formation is at or near the surface and commonly is capped with loess that is a few inches to a few feet thick. Platner soils are the most common soils in these areas. Canyon soils are an example of the soils in these areas that have little or no loess overlying bedrock. Richfield soils are an example of soils that have a loess cap several feet thick.

The landscape in these areas is dotted with undrained depressions that range from less than an acre to as much as 30 acres in size. Most of these depressions are less than 7 acres in size and are 15 to 40 feet deep (*8*). The small hills and rounded knolls in these upland areas are erosional remnants of the mortar beds that cap the Ogallala Formation. Canyon, Dioxice, and Iliff soils are on these hills and knolls. Surface drainage is provided by intermittent streams that flow generally eastward and terminate in the sandhills.

Upland areas underlain by loess commonly known as the Sanborn Formation are the areas of nearly level tablelands in the southeastern part of the county. The loess in these areas is as much as 85 feet thick (*8*). The surface of the tablelands is dotted with depressions that are similar to those in the upland areas underlain by the Ogallala Formation. The peripheral areas of the tablelands have been deeply dissected by erosion and are characterized by rugged ravines and bare, nearly vertical cliffs. Kuma and Keith soils are on the nearly level part of the tablelands. Colby soils are on the dissected slopes in the peripheral areas. Surface drainage is provided by the dendritic gullies and drainageways that lead to the Republican and Arikaree Rivers, which flow eastward. The total relief between the Republican River and the tablelands at Idalia is about 400 feet.

The *upland dune sand areas* are characterized by two distinct types of dunes. The first type of dune is northwest-trending and generally overlies the Ogallala Formation. Dunes of this type are in the northeastern part of the county. Topographically, these dunes range from a series of low hills that have relatively flat crests separated by saddles to irregular sandhills that have a maximum local relief of about 170 feet. The areas of this kind of dune characteristically have interior drainage. At times, the water table rises above the land surface and forms lakes in some of the flat interdune areas (*8*).

The second type of dune overlies the Sanborn Formation. Dunes of this type are in the south-central part of the county extending to the Arikaree River. They consist of particles that grade imperceptibly from the silt of the underlying loess to the sand that characterizes dunes of the first type.

Valent soils are the main soils in the upland dune sand areas.

The *valley areas* are in the east-central and southeastern parts of Yuma County along the Republican and Arikaree Rivers and their tributaries. The soils in these areas formed on flood plains. They include the somewhat excessively drained Bankard soils, the well drained Glenberg and Haverson soils, and the poorly drained Las Animas and Platte soils.

The Ogallala Formation is exposed as bluffs along the south side of the North Fork of the Republican River at Wray. It is composed of beds of silt, sand, gravel, caliche, and clay. The gravel and sand in the Ogallala Formation are concentrated mainly in winding narrow bands that extend eastward or southeastward. These bands represent former channels of the shifting streams that deposited the Ogallala Formation (*8*).

Pierre Shale, which underlies the Ogallala Formation, is exposed on the dissected side slopes of the valleys. Pierre Shale is the parent material of Razor and Midway soils.

history and development

The area that is now Yuma County is part of the land acquired by the United States through the Louisiana Purchase. The northern half of this area, originally part of Washington County, was organized in 1889 with Yuma as the county seat. In 1903, the southern half was annexed from Arapahoe County, and the county seat was moved to Wray.

Large cattle companies were the first to make use of the land in Yuma County. After the passage of the Homestead Act in 1900, land was acquired by homesteaders, who began using it for crops.

As more homesteaders arrived, small communities developed throughout the county. Many of these communities disappeared as travel became easier due to mechanization, and only the towns in a central location or along the railroad remained. Wray and Yuma are now the major trade centers in Yuma County.

In the 1940's, during the war years, high crop prices stimulated farmers to convert grassland to dryland farms. However, the cyclical nature of drought revealed that not all this land was suitable for farming, and many farms failed.

In the past decade, the ground water resources in Yuma County have been developed for use in irrigation, and more and more land in the county is being converted to irrigation management. According to the Yuma County Abstract of Assessment, 9,981 acres was under irrigation in 1966, 110,643 acres in 1971, and 185,158 acres in 1976. These figures do not include meadows and irrigated pastures, which totalled 17,089 acres in 1976. In 1976, 387,372 acres was used as nonirrigated cropland, and 855,975 acres was used as grazing land.

According to the 1976 Colorado Agricultural Statistics, 133,000 acres was used for winter wheat in 1974, 114,000 acres for corn grown for grain, 72,000 acres for alfalfa, 17,500 acres for grain sorghum, 11,000 acres for sugar beets, 7,300 acres for corn for silage, and 4,000 acres for dry-shelled beans.

The livestock industry has remained somewhat constant in the last decade. The estimated number of cattle and calves was 139,500 in 1971 and 159,000 in 1974. Cattle on feed numbered 30,500 in 1971 and 29,000 in 1974. The number of milk cows was 2,600 in 1971 and 2,000 in 1972. The number of hogs decreased significantly from 15,000 in 1971 to 1,800 in 1974.

natural resources

The main natural resources in Yuma County are the soils, underground water, and wildlife. The gravel deposits in the county are not considered a major natural resource because the gravel is not of good quality and the demand for gravel is low.

The underground water is in gravel layers of the Ogallala Formation, which underlies most of the county. The thickness of the gravel layer determines the quantity of water that a well can produce. In the past, settlers used the underground water for livestock. In the 1960's, underground water began to be widely used for irrigation. Today, there are about 1,500 irrigation wells in the county. The wells are 50 to 250 feet deep to the static water table. The maximum depth to the underlying shale is about 450 feet. The average production for the wells in Yuma County is about 800 gallons of water per minute.

The soils are the most important natural resource in Yuma County. Many soils in the county are well suited to irrigation. Soils are used for irrigated and nonirrigated crops and for grasses that are used for grazing livestock.

In addition, the soils support vegetation that provides habitat for a variety of openland and rangeland wildlife. Pheasant, quail, and sagehen are among the small game wildlife species in Yuma County. The big game animals include mule deer, white-tailed deer, and pronghorn antelope.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined

management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Ascalon-Haxtun-Platner

Nearly level to undulating, deep, well drained loamy sands, sandy loams, and loams; on smooth plains

These soils formed in wind-reworked or loess-capped alluvium of the Ogallala Formation. This map unit makes up 17 percent of the survey area. It consists of about 30 percent Ascalon soils, 30 percent Haxtun soils, 20 percent Platner soils, and 20 percent minor soils.

Ascalon soils have a surface layer of loamy sand, sandy loam, or fine sandy loam and a subsoil of sandy clay loam. The substratum is fine sandy loam and is coarser with increasing depth. These soils are nearly level to very gently undulating and are on generally convex plains.

Haxtun soils have a surface layer of loamy sand or sandy loam and a buried subsoil of sandy clay loam. The substratum is sandy loam. These soils are in swalelike areas on plains.

Platner soils have a surface layer of loam or sandy loam and a subsoil of clay loam. The substratum is gravelly sand. These soils are nearly level and are on plains.

The minor soils include the Albinas, Richfield, Iliff, Canyon, Rago, and Paoli soils. Albinas and Paoli soils are on flood plains. Richfield, Iliff, and Canyon soils are on upland plains. Rago soils are the most extensive minor soils in this map unit. They are in swalelike areas and on flood plains.

The soils making up this map unit are used mainly as irrigated and nonirrigated cropland. Wheat is the principal crop on nonirrigated cropland. Corn, sugar beets, and pinto beans are grown on irrigated cropland. Controlling soil blowing and water erosion is the major management problem. Stripcropping and stubble mulching help to minimize soil blowing and water erosion. A crop-fallow cropping system conserves moisture on nonirrigated cropland. Returning crop residue to the soil is effective in controlling soil blowing on irrigated and nonirrigated cropland.

If a good management system is applied, these soils have good potential for increased crop production. They have good potential for use as habitat for openland wildlife.

2. Kuma-Keith

Nearly level to gently undulating, deep, well drained silt loams; on smooth plains

These soils formed in loess. The map unit makes up 13 percent of the survey area. It consists of about 50 percent Kuma soils, 30 percent Keith soils, and 20 percent minor soils.

Kuma soils have a surface layer of silt loam and a subsoil of silty clay loam. The lower part of the subsoil is a buried layer of darker colored silty clay loam. The substratum is silt loam and loam. These soils are nearly level to gently undulating and are on plains.

Keith soils have a surface layer of silt loam and a subsoil of silty clay loam. The substratum is silt loam. These soils are nearly level to gently undulating and are on plains.

The minor soils include the Colby and Rago soils. Rago soils are in swales. Colby soils are sloping and are on low hills.

The soils making up this map unit are used mainly as irrigated and nonirrigated cropland. Wheat is the principal crop on nonirrigated cropland. Corn and sugar beets are the principal crops on irrigated cropland. Controlling soil blowing and water erosion is the major management problem. Terraces minimize runoff, thus reducing soil and water losses. Stubble mulching and stripcropping minimize soil blowing. Returning crop residue to the soil and good irrigation management are effective in controlling soil blowing and water erosion on irrigated cropland.

If a good management system is applied, these soils have good potential for increased crop production. They have good potential for use as habitat for openland wildlife.

3. Valent

Undulating to steep, deep, excessively drained sands; on low sandhills

These soils formed in eolian sand. The map unit makes up 35 percent of the survey area. It consists of about 95 percent Valent soils and 5 percent minor soils.

Valent soils have a surface layer of sand. The underlying material is sand.

The minor soils include the Dailey, Dwyer, and Inavale soils. Dailey soils are level or nearly level and are in sandhill valleys. Dwyer soils are rolling and sloping and are on sandhills, mainly in the southern part of the county. Inavale soils are in sandhill valleys.

The soils making up this map unit are used mainly for grazing livestock and as sprinkler-irrigated cropland. Corn is the main crop. Controlling soil blowing and water erosion is the major management problem. On rangeland, maintaining an adequate cover on the soil minimizes soil blowing. Returning crop residue to the soil and rotating grasses and legumes in the cropping system minimize soil blowing and water erosion on cropland.

These soils have good potential for the production of native forage if sand sagebrush is controlled and other grazing management practices are applied. They have fair potential for use as habitat for rangeland wildlife if game management practices are applied along with range management.

4. Julesburg-Haxtun-Manter

Nearly level to undulating, deep, well drained loamy sands and sandy loams; on smooth plains and in sandhill valleys

These soils formed in eolian sand. The map unit makes up 19 percent of the survey area. It consists of about 40 percent Julesburg soils, 30 percent Haxtun soils, 25 percent Manter soils, and 5 percent minor soils.

Julesburg soils have a surface layer of loamy sand and a subsoil of sandy coarse loam. The substratum is sand. These soils are nearly level to undulating and are on smooth plains.

Haxtun soils have a surface layer of loamy sand and a buried subsoil of sandy clay loam. The substratum is sandy loam. These soils are nearly level and are in sandhill valleys.

Manter soils have a surface layer and subsoil of sandy loam or loamy sand. The substratum is sandy loam. These soils are nearly level to undulating and are on smooth plains.

The minor soils include the Laird, Ascalon, Vona, and Terry soils. Ascalon, Terry, and Vona soils are nearly level to sloping and are on smooth plains. Laird soils are nearly level and are on sandhill valleys.

The soils making up this map unit are used mainly for grazing livestock and as sprinkler-irrigated cropland and pastureland. Corn, alfalfa, and small grains are grown on the irrigated cropland. Grasses adapted to the sandy plains are grown on the irrigated pastureland. Controlling soil blowing and water erosion is the major management problem. Proper range use minimizes soil blowing and water erosion. Returning crop residue to the soil, rotating grasses and legumes in the cropping system, stripcropping, and good irrigation management minimize soil blowing and water erosion on sprinkler-irrigated cropland.

These soils have good potential for use as irrigated cropland if soil blowing is controlled. In nonirrigated areas, the potential of these soils is highest for the production of native grass if sand sagebrush is controlled and other grazing management practices are applied. These soils have fair potential for use as habitat for rangeland wildlife if game management practices are applied.

5. Colby

Gently sloping to hilly, deep, well drained silt loams; on low hills

The soils in this map unit formed in loess. They make up 9 percent of the survey area. The map unit consists of about 95 percent Colby soils and 5 percent minor soils.

Colby soils have a surface layer of silt loam. The underlying material is silt loam.

The minor soils include the Keith, Kuma, Stoneham, and Canyon soils. Keith and Kuma soils are gently undulating and are on smooth upland plains. Stoneham soils are nearly level and are on high upland terraces. Canyon soils are nearly level to hilly and are on hills and ridges on uplands.

The soils making up this map unit are used mainly for grazing by livestock. Controlling water erosion is the main management problem. Proper range use minimizes water erosion.

These soils have good potential for forage production if good grazing management practices are applied. They have fair potential for use as habitat for rangeland wildlife if game management practices are applied along with grazing management.

6. Canyon-Bayard

Gently sloping to hilly, shallow and deep loams and fine sandy loams; on fans, ridges, foot slopes, hills, and knolls

These soils formed in alluvium and residuum of highly calcareous sandstone. This map unit makes up 5 percent of the survey area. It consists of about 75 percent Canyon soils, 15 percent Bayard soils, and 10 percent minor soils.

Canyon soils are shallow and have a surface layer of loam overlying white, highly calcareous sandstone. They are gently sloping to hilly on knolls, hills, and ridges.

Bayard soils are deep and have a surface layer of fine sandy loam overlying calcareous fine sandy loam. The substratum is calcareous loamy fine sand. Bayard soils are gently sloping and are on alluvial fans and foot slopes.

The minor soils include the Razor, Kim, and Midway soils. Midway and Razor soils are gently sloping and are on ridge crests and dissected side slopes. Kim soils are gently sloping and are on alluvial fans.

The soils making up this map unit are used mainly for grazing by livestock. Controlling soil blowing on rangeland is the main management problem. Proper range use helps to control soil blowing and water erosion.

The potential of the soils is highest for forage production if good grazing management practices are applied. The potential is good for rangeland wildlife habitat if game management practices are applied along with range management.

7. Bankard-Haverson-Las Animas

Nearly level, deep, somewhat excessively drained, well drained, and poorly drained sands, loams, and fine sandy loams; on flood plains and second-bottom terraces

The soils in this map unit formed in alluvium. They make up 2 percent of the survey area. The map unit consists of about 35 percent Bankard soils, 25 percent Haverson soils, 20 percent Las Animas soils, and 20 percent minor soils.

Bankard soils are somewhat excessively drained and have a surface layer of sand overlying stratified sand. They are on flood plains and second-bottom terraces.

Haverson soils are well drained. They have a surface layer of loam and a substratum of silty clay loam. They are nearly level and are on flood plains and second-bottom terraces.

Las Animas soils are poorly drained and have a surface layer of fine sandy loam or loam. The substratum is coarse sand. These soils are nearly level and are on flood plains.

The minor soils include the Paoli, Platte, and Glenberg soils. Paoli and Glenberg soils are nearly level and are on flood plains and second-bottom terraces. Platte soils are nearly level and are on flood plains.

The soils making up this map unit are used mainly as hayland, pastureland, and irrigated cropland. Controlling soil blowing is the main management problem. Proper management of hayland and of irrigation water help to control soil blowing.

The potential of the soils is highest for the production of forage. Forage production can be increased through good management of hay meadows and pasture. The Las Animas soils have good potential for use as habitat for wetland wildlife.

broad land use considerations

Most of the cropland in the county is in the Ascalon-Haxtun-Platner and Kuma-Keith map units. More than 90 percent of the soils in these map units are used for crops.

Most of the soils in the Valent, Colby, and Canyon-Bayard map units are used as rangeland. Less than 10 percent of the soils in these map units are used for crops; most of this cropland is in the Valent map unit, where ground water is used for irrigation.

Most of the soils in the Julesburg-Haxtun-Manter and Bankard-Haverson-Las Animas map units are used as rangeland. These soils are best suited to this use.

The soils in the Ascalon-Haxtun-Platner and Kuma-Keith map units have the greatest potential for increased crop production.

Most of the soils in Yuma County are well suited or fairly well suited to use as sites for houses and sanitary facilities. The soils in the Bankard-Haverson-Las Animas map unit are on flood plains and have severe limitations to urban uses or as sites for housing because of the hazards of flooding and wetness. The Canyon-Bayard map unit has severe limitations to these uses because the Canyon soil and the minor Razor and Midway soils are shallow to rock; in addition, the Razor and Midway soils have a high shrink-swell potential.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ascalon sandy loam, 3 to 5 percent slopes, is one of several phases in the Ascalon series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. The Glenberg-Bankard complex is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Albinas loam. This is a deep, well drained, nearly level soil on flood plains and stream terraces, mainly in the western part of the county. It formed in recent alluvium that derived from mixed sources and was deposited by intermittent streams.

Included in mapping are Haxtun sandy loam and Paoli sandy loam. The Paoli soil is in narrow strips along intermittent streams. The Haxtun soil is mainly on the flood plain of Red Willow Creek in Range 46 W. Paoli and Haxtun soils make up about 10 percent of this map unit.

Typically, the surface layer is grayish brown loam about 6 inches thick. The subsoil is grayish brown clay loam about 25 inches thick. The substratum, to a depth of 60 inches or more, is pale brown, highly calcareous loam. In places, there is a thin stratum of sand in the surface layer or subsoil. In other places, the subsoil is loam, and lime is at a greater depth than is typical.

Permeability is moderate. The available water capacity is high. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard. Very brief flooding can occur once or twice in a 10-year period.

About 60 percent of the acreage of this map unit is cropped. About 40 percent is rangeland. The Albinas soil is easy to till and is well suited to all climatically adapted crops. Wheat and corn are the main crops on nonirrigated cropland. This soil is also well suited to less intensive uses such as pasture, hayland, and rangeland.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth. Soil blowing can be controlled by leaving crop residue on the surface when the soil is not being used for crops. Soil tilth can be maintained by incorporating crop residue into the surface layer, by subsoiling once every 3 or 4 years,

and by minimizing tillage. This soil is suited to sprinkler irrigation or surface application of irrigation water. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep. This soil is fertile; however, high-yield irrigated crops can cause a nutrient deficiency. Soil tests should determine the amount of fertilizer needed. Liberal applications of phosphorus and nitrogen fertilizers are needed where the light-colored substratum material has been exposed by erosion or land leveling. The infrequent overflow can damage crops. In some fields, low dikes can be constructed to protect crops from overflow.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. Soil blowing can be controlled and moisture can be conserved through the use of stubble mulch tillage and stripcropping. Soil tilth can be maintained by incorporating crop residue into the soil and by subsoiling every 3 or 4 years to improve permeability.

The potential native vegetation on this soil is dominantly blue grama, buffalograss, western wheatgrass, sedge, and green needlegrass. If the range is overgrazed, all these grasses, except blue grama, tend to decrease in number and are replaced by sand dropseed, ring muhly, and various forbs and annuals. Blue grama tends to increase if range is overgrazed. Deferred grazing, range fencing and seeding, developing stock watering facilities, and water spreading as needed are effective in maintaining rangeland.

Rangeland can be seeded or cropland can be converted to grass using a mixture selected from the recommended varieties of western wheatgrass, little bluestem, sideoats grama, and crested, pubescent, or intermediate wheatgrass. The seedbed should be firm and as free as possible of perennial plant competition. The clean, firm stubble of sorghum or millet is suitable as a seedbed. Seeding should take place early in spring for best results.

This soil has good potential for the development of habitat for openland wildlife such as pheasant, cottontail, mourning dove, and songbirds. The habitat for openland wildlife can be improved by planting trees and shrubs and by establishing undisturbed nesting cover. Windbreak plantings provide good cover. Food for wildlife can be provided by planting species such as Russian-olive, American plum, and honeysuckle.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year before plantings, applying supplemental water during planting and in the early stages of growth, and continued cultivation to control weeds are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is not well suited to use as sites for housing because of the flood hazard.

Capability subclass IIw, nonirrigated and irrigated.

2—Ascalon loamy sand, 3 to 9 percent slopes. This is a deep, well drained, gently undulating to gently rolling soil on smooth plains. It formed in calcareous old alluvium. The areas are irregular in shape and range to 40 acres in size near sandhills.

Included in the mapped areas is Manter loamy sand, which makes up as much as 15 percent of the map unit.

Typically, the surface layer is grayish brown loamy sand about 8 inches thick. The subsoil is grayish brown sandy clay loam about 21 inches thick. The substratum, to a depth of 37 inches, is pale brown sandy loam. Below that, to a depth of 60 inches or more, it is very pale brown, calcareous fine sandy loam.

Permeability is moderate. The available water capacity is moderate. Surface runoff is medium. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

In most areas, this soil is in native grass. In some areas, it is sprinkler-irrigated cropland, and in a few areas, it is nonirrigated cropland. If soil blowing is controlled, this soil can be highly productive for corn under sprinkler irrigation. It can also be used for irrigated pasture or hay.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be minimized by leaving crop residue on the surface when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch for the emerging seedlings. Grasses and legumes grown in rotation as much as half of the time help to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps to reduce the hazard of soil blowing.

This soil is suited to sprinkler irrigation. Frequent light applications of water make the most efficient use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers if irrigation is excessive or irrigation equipment is improperly maintained. Large amounts of fertilizer that adds nitrogen and phosphorus to the soil, applied at rates determined by soil tests, are needed for profitable crop yields.

This soil is only marginally suited to nonirrigated crops. The main concerns in managing nonirrigated cropland are controlling water erosion and soil blowing and conserving soil moisture. The essential conservation practices are stripcropping at right angles to the prevailing wind and stubble mulch tillage. Where slopes are long enough to permit their use, farming on the contour and terracing help to reduce runoff and conserve water. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue, which helps to reduce soil blowing and to trap snow. A cropping system of row crops grown annually or

alternated with wheat helps to better protect the soil from soil blowing and washing; however, yields will be less.

Cultivated fields can be converted to grass by seeding a mixture selected from crested, intermediate, or pubescent wheatgrass; sand bluestem; prairie sandreed; blue grama; switchgrass; indiangrass; and sideoats grama. The clean, firm stubble of sorghum or millet is suitable as a seedbed. For best results, seeding should take place early in spring.

The potential native vegetation on this soil is dominantly prairie sandreed, blue grama, sand bluestem, switchgrass, and needleandthread. If the range is overgrazed, sand bluestem, prairie sandreed, switchgrass, and needleandthread will decrease, and sand sagebrush, sand dropseed, and bush wild buckwheat will increase. Optimum ground cover is between 35 and 45 percent. Deferred grazing, seeding, and sagebrush management help in maintaining range.

Badly depleted range can be improved by seeding with a mixture selected from recommended varieties of sand bluestem, little bluestem, sideoats grama, blue grama, prairie sandreed, switchgrass, indiangrass, and crested, intermediate, or pubescent wheatgrass. The seedbed should be firm and as free as possible of perennial plant competition.

Wildlife habitat, openland and rangeland wildlife habitat in particular, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and needs to be established in developing habitat for this species, especially in areas of intensive agriculture. Windbreak plantings can provide good cover. Russian-olive, American plum, skunkbush sumac, and other similar species can provide food. Rangeland wildlife, for example, the pronghorn antelope, can be assisted and encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding where needed.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation in establishing trees and shrubs. This hazard can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IVe, nonirrigated and irrigated.

3—Ascalon sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently undulating soil in areas between sandhills and hardlands. It formed on plains in calcareous old alluvium. The areas of this soil are irregular in shape and range to 200 acres in size.

Included in mapping are areas of severely eroded soils as much as 5 acres in size. In these areas, the surface layer and subsoil have been blown away by wind, exposing the calcareous substratum material (fig. 1).

Figure 1.—In the light-colored area in this field, water erosion, soil blowing, or land leveling has removed the surface layer and subsoil and exposed the light-colored substratum material.

Also included are small areas of Manter sandy loam on narrow ridges. This soil makes up no more than 10 percent of this map unit.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is brown sandy clay loam about 12 inches thick. The substratum, to a depth of about 44 inches, is very pale brown, calcareous fine sandy loam. Below that, to a depth of 60 inches or more, it is very pale brown, calcareous fine sand. South of the Arikaree River, the substratum is thinner than is typical and is loamy coarse sand below a depth of 34 inches.

This soil is easy to till. Permeability and the available water capacity are moderate. Surface runoff is medium. Water erosion is a slight hazard, and soil blowing is a severe hazard.

In most areas, this soil is used for nonirrigated and sprinkler-irrigated crops. The nonirrigated cropland is used mainly for winter wheat in a crop-fallow sequence. Other nonirrigated crops include millet and sorghum. Corn is the principal irrigated crop. This soil is also well suited to less intensive uses such as hay, pasture, or native rangeland.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and stripcropping. Where slopes are long enough to permit their use, terracing and farming on the contour are effective in reducing runoff. Light applications of nitrogen fertilizer normally result in larger amounts of crop residue, which helps to reduce soil blowing and to trap snow.

The main concerns in managing irrigated cropland are controlling soil blowing, which can reduce the organic matter content of this soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue on the surface when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore organic matter lost by soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizers are needed where substratum material has been exposed by land leveling or soil blowing.

The potential vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. Overgrazing will cause sand bluestem, switchgrass, and needleandthread to decrease in number and sand sagebrush, sand dropseed, and bush wild buckwheat to increase.

Deteriorated range can be improved by seeding with a mixture selected from recommended varieties of sand bluestem, little bluestem, sideoats grama, blue grama, switchgrass, indiangrass, and intermediate, crested, or pubescent wheatgrass. The seedbed should be firm and as free as possible of perennial plant competition. Other effective range management practices include deferring grazing and controlling sand sagebrush.

Cultivated fields can be converted to grass by seeding with a mixture selected from sand bluestem, switchgrass, blue grama, prairie sandreed, indiangrass, sideoats grama, and crested, intermediate, or pubescent wheatgrass. The clean, firm stubble of sorghum or millet is suitable as a seedbed. For best results, seeding should take place early in spring.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Openland wildlife can be encouraged by planting windbreaks for cover and by establishing species such as Russian- olive, skunkbush sumac, and Siberian peashrub for food. Rangeland wildlife, for example, the pronghorn antelope, can be assisted and encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding where needed.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation in establishing trees and shrubs. This hazard can be overcome by cultivating only in the tree row and by leaving a strip of vegetative cover between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as sites for houses, but, because of the somewhat low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIIe, nonirrigated and irrigated.

4—Ascalon sandy loam, 5 to 9 percent slopes. This is a deep, well drained, undulating soil. It formed on plains in calcareous old alluvium.

Included in the mapped areas are small areas of Eckley gravelly sandy loam on ridges and small knolls. This soil makes up as much as 5 percent of this map unit.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is grayish brown

sandy clay loam about 12 inches thick. The substratum, to a depth of 60 inches, is very pale brown, calcareous loam and fine sandy loam. In places, the soil material below a depth of 40 inches is loamy sand.

Permeability is moderate. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

About half of the acreage of this map unit is used for grazing and half for nonirrigated wheat or sorghum. Millet is grown occasionally. A common cropping sequence is small grains or grain sorghum alternated with fallow.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be minimized by leaving crop residue standing on the surface when crops are not grown. Seeding directly into tilled stubble can protect emerging seedlings from damage by soil blowing. Grasses and legumes grown in rotation as much as half of the time help to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps to reduce the hazard of soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water make the most efficient use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers if irrigation is excessive due to inadequate management or improperly maintained irrigation equipment. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, are needed for profitable crop yields.

The main concerns in managing nonirrigated cropland are controlling water erosion and soil blowing and conserving soil moisture. Essential conservation practices are stubble mulch tillage and stripcropping. Where slopes are long enough to permit their use, farming on the contour and terracing help to reduce runoff and conserve water. Light applications of nitrogen fertilizer normally result in larger amounts of crop residue which helps to reduce soil blowing and to trap snow.

Cultivated fields can be seeded to grass using a mixture selected from crested, intermediate, or pubescent wheatgrass; sand bluestem; switchgrass; sideoats grama; prairie sandreed; blue grama; or indiangrass. The clean, firm stubble of sorghum or millet is suitable as a seedbed. For best results, seeding should take place early in spring.

The potential native vegetation on this soil is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. If the range is overgrazed, sand bluestem, switchgrass, blue grama, and needleandthread decrease in number, and sand sagebrush, sand dropseed, and bush wild buckwheat increase. Deferred grazing, seeding, and contour furrowing as needed help to maintain or improve range.

Deteriorated range can be seeded using a mixture selected from recommended varieties of sand bluestem, little bluestem, sideoats grama, switchgrass, indiangrass, and intermediate, pubescent, or crested wheatgrass. The seedbed should be firm and as free as possible of perennial plant competition.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting cover. Openland wildlife can be encouraged by planting windbreaks for cover and by establishing species such as cotoneaster, honeysuckle, and Russian-olive for food. Rangeland wildlife, for example, the pronghorn antelope, can be assisted and encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding where needed.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation in establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub. Erosion can be minimized by planting trees in contour furrows or on level terraces.

This soil is suited to use as homesites, but, because of the somewhat low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IVe, nonirrigated and irrigated.

5—Ascalon fine sandy loam, 0 to 3 percent slopes. This is a deep, well drained nearly level soil. This soil formed on plains in calcareous old alluvium. The areas are irregular in shape and range to 300 acres in size. They are mainly in the southwestern and northwestern parts of the county.

Included in mapping are small areas of Manter sandy loam on convex slopes and Haxtun sandy loam on concave slopes. The Manter soil makes up about 5 percent of this map unit, and the Haxtun soil makes up as much as 20 percent. Also included are a few areas, about 1 acre in size, of severely eroded soils.

Typically, the surface layer is grayish brown fine sandy loam about 6 inches thick. The subsoil is grayish brown and brown sandy clay loam about 12 inches thick. The substratum, to a depth of 44 inches, is brown and very pale brown, calcareous fine sandy loam. Below that, to a depth of 60 inches or more, it is very pale brown, calcareous loamy fine sand. South of the Arikaree River, the substratum is thinner than is typical and is loamy coarse sand at a depth of about 34 inches.

This soil is easy to till. Permeability and the available water capacity are moderate. Surface runoff is medium. Water erosion is a slight hazard, and soil blowing is a severe hazard.

This soil is well suited to nonirrigated and sprinkler-irrigated crops. In most areas, this soil is used for nonirrigated winter wheat. Other nonirrigated crops are millet and sorghum. Corn is the main irrigated crop. This soil is also well suited to less intensive uses such as hay, pasture, or rangeland.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining fertility. Soil blowing can be controlled by leaving crop residue on the surface when crops are not grown. Seeding directly into tilled stubble can protect emerging seedlings from damage by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore organic matter lost by soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing. Growing grasses and legumes also help to maintain or improve soil fertility and tilth.

Sprinkler irrigation is commonly used on this soil. Surface irrigation is feasible with some land leveling. High crop yields can be expected if irrigation water is used efficiently. Nutrient deficiencies can occur. Soil tests should determine the amount of fertilizer needed. Liberal applications of phosphorus and nitrogen fertilizer are needed where substratum material has been exposed by land leveling or erosion. Minimizing tillage on irrigated cropland helps to maintain soil tilth.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. Soil blowing can be controlled and moisture conserved by leaving crop residue on the surface, stubble mulch tillage, and stripcropping. Light application of nitrogen fertilizer normally results in larger amounts of crop residue, which helps reduce soil blowing and trap snow. A cropping system of small grains alternated with row crops or small grains alternated with fallow is commonly used on nonirrigated cropland.

The potential vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. If the range is overgrazed, these grasses will decrease, and blue grama and sedges will increase. Deferred grazing is the most effective practice in maintaining range in good condition.

This soil has good potential for the development of habitat for openland wildlife, including pheasant, cottontail, mourning dove, and songbirds, especially in areas under irrigation where a great variety of crops and cover types can be grown. The habitat for openland wildlife can be improved by planting trees and shrubs and by establishing undisturbed nesting cover. Sand cherry, American plum, cotoneaster, and similar species can provide food. The trees and shrubs recommended for use in windbreaks can provide cover. Rangeland wildlife, including antelope, jackrabbit, lark bunting, and horned lark, can be encouraged on grasslands by properly grazing livestock, by fencing to permit the free movement of antelope, and by developing livestock watering facilities.

Cultivated fields can be converted to grass by seeding with a mixture selected from crested, pubescent, or intermediate wheatgrass; little bluestem; indiangrass; sand bluestem; switchgrass; and blue grama. Wheat stubble or a cover of millet is suitable as a seedbed. For best results, seeding should take place early in spring.

The potential native vegetation on this soil is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. If rangeland is overgrazed, blue grama, bluestem, prairie sandreed, switchgrass, and needleandthread decrease in number, and sand sagebrush, sand dropseed, and bush wild buckwheat increase. Deferred grazing, seeding, livestock watering facilities, and sand sagebrush management help to maintain or improve range.

Deteriorated range can be seeded using a mixture selected from recommended varieties of sand bluestem, little bluestem, sideoats grama, switchgrass, prairie sandreed, indiangrass, and crested, intermediate, or pubescent wheatgrass. The seedbed should be firm and as free as possible of perennial plant competition.

This soil has good potential for the development of habitat for openland wildlife such as pheasant, cottontail, mourning dove, and songbirds, especially in areas under irrigation where a great variety of crops and cover types can be raised and developed. The habitat for openland wildlife can be improved by planting trees and shrubs and by establishing undisturbed nesting cover. Cover and food for openland wildlife can be provided by establishing windbreaks that include plantings of honeysuckle, cotoneaster, and other species that wildlife use for food. Rangeland wildlife, for example, antelope, jackrabbit, lark bunting, and horned lark, can be encouraged on the grasslands by properly grazing livestock, by fencing to permit the free movement of antelope, and by developing livestock watering facilities.

This soil is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as sites for housing, but, because of the somewhat low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin to support the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIe, nonirrigated and irrigated.

6—Bankard sand. This is a deep, somewhat excessively drained soil along stream beds. It formed in stratified sandy alluvium on nearly level flood plains and second-bottom terraces. The areas of this soil are elongated and are as much as 100 acres in size.

Included in mapping are areas, as much as 5 acres in size, of Platte fine sandy loam and Haverson loam. These soils make up less than 10 percent of this map unit.

Typically, the surface layer is light brownish gray sand about 5 inches thick. The underlying material is very pale brown, calcareous sand to a depth of 60 inches or more.

Permeability is very rapid. The available water capacity is low. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard. Flooding occurs frequently for brief periods.

This soil is used as rangeland. In places, the seasonal water table is at a depth of about 6 feet and is favorable for some deeply rooted grasses. The vegetation on this soil varies widely in type and quantity and can include grasses, woody shrubs, and cottonwood trees. Range condition can be improved by interseeding using a mixture selected from sand bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

The potential native vegetation is dominantly switchgrass, sand bluestem, blue grama, needleandthread, and prairie sandreed. If the range is overgrazed, sand bluestem, prairie sandreed, switchgrass, and needleandthread tend to decrease in number, and blue grama, sand sagebrush, and annual grasses and forbs tend to increase. Good range management practices on this soil include deferred grazing, grass seeding, fencing, and sand sagebrush management.

Deteriorated range can be improved by seeding to a mixture selected from sand bluestem, little bluestem, sideoats grama, blue grama, prairie sandreed, Indian ricegrass, switchgrass, and crested, intermediate, or pubescent wheatgrass in a prepared seedbed. New plantings should be protected from grazing for two growing seasons.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on nearby cropland, pastureland, and hayland by establishing nesting and escape cover. The natural plant cover, particularly in areas where there are shrubs and trees, can provide habitat for openland wildlife. Rangeland wildlife, for example, the white-tailed deer, can be assisted and encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding where needed.

This soil is suited to the production of cottonwoods. It can produce about 9,400 board feet (Doyle rule) of merchantable timber from a fully stocked, even-aged, managed stand of 40-year-old trees. The flood hazard restricts the use of this soil for the production of wood crops.

This soil is very poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine the feasibility for plantings.

This soil is poorly suited to use as homesites because of the flood hazard.

Capability subclass VIw, nonirrigated and irrigated.

7—Bayard fine sandy loam, 2 to 6 percent slopes. This is a deep, well drained, gently undulating soil on alluvial fans and foot slopes, typically below outcrops of limestone. This soil formed in wind-reworked, calcareous, moderately sandy material. The areas of this soil are in the eastern part of the county. They are elongated and range to 600 acres in size.

Included in mapping and making up about 15 percent of this map unit are areas of limestone outcrops, Kim loam, Razor clay loam, and Midway silty clay loam.

Typically, the surface layer is grayish brown fine sandy loam about 15 inches thick. The underlying material, to a depth of 36 inches, is very pale brown, calcareous fine sandy loam. Below that, to a depth of 60 inches or more, it is very pale brown, calcareous loamy fine sand.

Permeability is moderately rapid. The available water capacity is moderate. Water erosion is a slight hazard, and soil blowing is a severe hazard. Surface runoff is medium.

About 90 percent of the acreage of this map unit is rangeland. About 10 percent is irrigated cropland.

The main concerns in managing irrigated cropland are maintaining soil fertility and controlling soil blowing. Soil blowing can result in large losses of the organic matter in the soil. It can be controlled by leaving crop residue lying on the surface or standing as stubble when crops are not grown. Crops can be seeded directly into the tilled residue which can protect emerging seedlings from damage by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore the organic matter lost through soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizers are needed where substratum material has been exposed by land leveling or soil blowing.

The potential native vegetation on this soil is dominantly switchgrass, sand bluestem, blue grama, needleandthread, and prairie sandreed. If the range is overgrazed, sand bluestem, switchgrass, prairie sandreed, and needleandthread tend to decrease in number, and blue grama, sand sagebrush, sand dropseed, and bush wild buckwheat tend to increase.

Good range management on this soil includes deferred grazing, grass seeding, fencing, and sand sagebrush management.

Cropland can be converted to range or deteriorated range can be improved by seeding using a mixture selected from sand bluestem, little bluestem, sideoats grama, blue grama, prairie sandreed, Indian ricegrass, switchgrass, and crested, intermediate, or pubescent wheatgrass in a prepared seedbed. Plantings should be protected from grazing until the end of the second growing season.

This soil can provide habitat for rangeland wildlife, for example, the pronghorn antelope and sharptail grouse. Sharptail grouse can be encouraged on this grassland soil, especially where brush species are interspersed with grasses and forbs. The key to the development of wildlife habitat on rangeland is properly grazing livestock so that the more desirable grass species are not overgrazed and the various brush species are not depleted.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation in establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetative cover between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as sites for houses and as septic tank filter fields.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

8—Canyon-Dioxice complex, 1 to 9 percent slopes. The soils making up this complex are gently sloping to moderately sloping. They are on the crest of small hills and rounded knolls in the northern and southeastern parts of the county. The areas are irregular in shape and range to 300 acres in size. Sandstone fragments and flagstones are scattered on the surface, especially where the soil has been tilled.

Canyon loam, 1 to 3 percent slopes, makes up about 50 percent of this complex, and Dioxice fine sandy loam, 3 to 9 percent slopes, makes up 30 percent. The remaining 20 percent consists of Bayard fine sandy loam, Iliff loam, and soils that are similar to Canyon soils except that they are shallow over limestone.

The Canyon soil is shallow and well drained. It formed in highly calcareous sandstone that caps the Ogallala Formation. Typically, the surface layer is grayish brown, calcareous loam about 8 inches thick. The layer below that is light brownish gray, calcareous loam about 4 inches thick. White, calcareous sandstone is at a depth of 12 inches.

Permeability is moderate, and the available water capacity is very low. The effective rooting depth is 6 to 20 inches. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

The Dioxice soil is deep and well drained. It formed in calcareous alluvium of the Ogallala Formation. Typically, the surface layer is grayish brown fine sandy loam about 9 inches thick. The subsoil is light gray, calcareous sandy clay loam about 15 inches thick. The substratum, to a depth of about 35 inches, is white, calcareous sandy clay loam. Below that, to a depth of 60 inches or more, it is pinkish white, calcareous sandy clay loam.

Permeability is moderately slow, and the available water capacity is high. Runoff is medium. Water erosion and soil blowing are severe hazards.

About 60 percent of the acreage of this complex is used for grazing. The rest is part of nonirrigated cropland used for wheat. The wheat is grown in a crop-fallow cropping system because of a soil moisture deficiency. The Canyon soil is poorly suited to annual cropping because of the low water-holding capacity and the low organic matter content.

The potential native vegetation on the Canyon soil includes little bluestem, sideoats grama, prairie sandreed, and threadleaf sedge. The potential native vegetation on the Dioxice soil includes blue grama, western wheatgrass, sideoats grama, green needlegrass, and sedge. If the range condition deteriorates, sand dropseed invades areas of the Dioxice soil, and blue grama increases. Mat plants, yucca, sedge, blue grama, and fringed sagebrush tend to increase in areas of the Canyon soil. Deferred grazing and range seeding are effective conservation practices.

Overgrazed range or areas of nonirrigated cropland can be seeded, although the low available water capacity of the Canyon soil does not provide a good guarantee of success. A seedbed prepared and seeded early in spring, when precipitation is most reliable, provides the best chance of success. A mixture selected from blue grama, sand bluestem, little bluestem, sideoats grama, prairie sandreed, indiangrass, switchgrass, and crested, intermediate, or pubescent wheatgrass has the best chance of becoming established. The competition from perennial plants should be minimal.

The Canyon soil is relatively unproductive of vegetation, especially in times of drought when production may be as low as 625 pounds per acre per year. Habitat for rangeland wildlife is a potential secondary use for this soil. Antelope and scaled quail, for example, could best be encouraged by properly grazing livestock, by installing livestock-watering facilities, and by range seeding where needed.

The soils making up this complex are very poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine if plantings are feasible.

These soils could be used as homesites, but the underlying rock of the Canyon soil, although rippable, presents problems in installing utility lines and constructing basements. The soils are poorly suited to

use as septic tank filter fields because of the difficulty of laying leach lines. If areas of suitable soils can not be located nearby, a pad of suitable soil material can be constructed and leach lines placed in it.

Capability subclass VIe, nonirrigated and irrigated.

9—Canyon-Rock outcrop complex, 9 to 25 percent slopes. This complex consists of Rock outcrop and an undulating to moderately steep soil on the rim of the valleys of the Republican and Arikaree Rivers. The areas are elongated and are up to 1,000 acres in size.

Canyon soil makes up 50 percent of the map unit, Rock outcrop 20 percent, Bayard fine sandy loam 20 percent, and Valent sand and Eckley gravelly sandy loam 5 percent each. Bayard and Valent soils are on slopes below outcroppings of caprock. The Eckley soil is on top of the caprock. In places, shale outcrops on the steep slopes of canyons below caprock.

The Canyon soil is shallow and well drained. It formed in sandstone that caps the Ogallala Formation. Typically, the surface layer is grayish brown, calcareous loam about 8 inches thick. The layer below that is light brownish gray, calcareous loam about 4 inches thick. White, calcareous sandstone is at a depth of 12 inches.

Permeability is moderate. The available water capacity is very low. The effective rooting depth is 6 to 20 inches. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

Rock outcrop consists of areas of barren, exposed, highly calcareous sandstone.

This complex is used as rangeland. The main concern of management is maintaining range in good condition.

The potential native vegetation on the Canyon soil is little bluestem, threadleaf sedge, prairie sandreed, sideoats grama, and blue grama. Continuous heavy grazing will cause an increase in the population of mat plants, yucca, sedges, fringed sagebrush, and blue grama and a decrease of the taller grasses.

Management of grazing on this soil can maximize the amount of forage on rangeland. Because of the steep slopes and rock outcrops, the use of machinery and seeding normally are not feasible.

This complex is relatively unproductive of vegetation, especially in times of drought when production may be as low as 625 pounds per acre per year. Rangeland wildlife, for example, the antelope and scaled quail, can be encouraged by developing livestock watering facilities, by proper livestock grazing management, and by range seeding, if needed.

This complex generally is not suited to windbreaks and environmental plantings. Onsite investigation is needed if plantings are contemplated.

This complex is not well suited to use as homesites because shallow soil, rockiness, and steep slopes cause severe construction problems. The Canyon soil is very poorly suited to use as septic tank filter fields. However, it is possible to find areas of included soils that may be suitable if downstream pollution can be avoided. In spite of construction difficulties, attractive sites for houses can be developed with careful site selection and design.

Capability subclass VIIs, nonirrigated.

10—Colby silt loam, 3 to 6 percent slopes. This is a deep, well drained, gently undulating soil. It formed in loess on plains. The areas of this soil are mainly in the southeastern part of the county. They are as much as 400 acres in size.

Included in mapping and making up about 15 percent of this map unit are areas of Kuma silt loam and Keith silt loam. These soils are at the base of slopes and in narrow swalelike areas.

Typically, the surface layer is light brownish gray, calcareous silt loam about 8 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous silt loam. In places, the surface layer is fine sandy loam. In some areas, it is darker and thicker than is typical.

Permeability is moderate. The available water capacity is high. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

About 80 percent of the acreage is nonirrigated cropland used for winter wheat. The wheat is grown in a crop-fallow sequence to conserve moisture. About 10 percent of the acreage is irrigated cropland, and about 10 percent is rangeland.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and tilth. Soil blowing can be controlled by incorporating crop residue into the surface layer. Incorporating residue into the surface layer can also improve soil tilth and water intake and reduce erosion. Minimum tillage helps to maintain tilth and reduce erosion. This soil is low in nitrogen, and fertilizer is needed. Grasses and legumes in rotation about one-fourth of the time help to maintain tilth and fertility and improve water intake.

This soil is suited to sprinkler irrigation. Water must be applied slowly to reduce runoff, and enough water must be applied to moisten the soil fairly deep.

The main concerns in managing nonirrigated cropland are controlling water erosion and soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and stripcropping. Where soil slopes are long enough to permit their use, terracing and farming on the contour help to reduce runoff. Because of the weak structure and low organic matter content, this soil is very susceptible to soil blowing during windy and droughty periods. Emergency tillage that leaves ridges on the surface at right angles to the prevailing wind can be effective temporarily. The best erosion-control practice is maintaining a protective cover throughout the year.

The potential native vegetation includes blue grama, buffalograss, western wheatgrass, sedges, and green needlegrass. Continuous heavy grazing causes western wheatgrass and green needlegrass to decrease and

causes blue grama and buffalograss to form a dense sod. Continued overuse will result in the invasion of undesirable plants. Overgrazing increases runoff and water erosion. Mechanical practices such as pitting and contour furrowing help to decrease runoff.

Badly deteriorated range can be improved or cropland converted to range by using a mixture selected from recommended varieties of western wheatgrass, little bluestem, sideoats grama, blue grama, and crested, pubescent, or intermediate wheatgrass. The seedbed should be firm and as free as possible of competition from perennial plants. The clean, firm stubble of sorghum or millet is suitable as a seedbed. For best results, seeding should take place early in spring.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be developed, especially in areas of intensive agriculture. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, if needed. Openland wildlife can be encouraged by planting the trees and shrubs generally adapted for windbreak plantings.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is well suited to use as sites for houses and as septic tank filter fields. However, because of the low bearing strength of this soil, foundation footings need to be sufficiently wide to provide a safety margin to support the weight of buildings.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

11—Colby silt loam, 6 to 15 percent slopes. This is a deep, well drained, rolling soil on low hills. It formed in calcareous loess. The areas of this soil are in the southeastern part of the county and are as much as 1,200 acres in size.

Included in mapping and making up about 10 percent of this map unit are Kuma silt loam and Keith silt loam and a dark-colored silty soil that is similar to this Colby soil and is at the base of slopes and in swales between hills.

Typically, the surface layer is light brownish gray, calcareous silt loam about 8 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous silt loam. In places, the surface layer is fine sandy loam. In some areas, the surface layer is darker than is typical.

Permeability is moderate. The available water capacity is high. Surface runoff is medium. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

About 90 percent of the acreage of this map unit is rangeland, and about 10 percent is used for nonirrigated winter wheat. This soil is not suited to nonirrigated row crops because erosion accelerates if the soil is tilled.

This soil is only marginally suited to irrigated crops because of the severe hazard of water erosion and the steepness of slopes. Erosion can be minimized by growing small grains, hay, or grasses at least half of the time, by leaving the crop residue on the soil, and by properly managing irrigation water.

The potential native vegetation is dominantly needleandthread, sideoats grama, little bluestem, western wheatgrass, and blue grama. Continuous heavy grazing causes little bluestem, sideoats grama, and western wheatgrass to decrease in the plant community; blue grama and buffalograss will increase, forming a dense, low-producing sod. Grazing management can help to reduce runoff and improve the range condition. Mechanical practices are effective on the gentler slopes.

Cropland can be converted to range or deteriorated range can be improved by seeding with a mixture selected from recommended varieties of western wheatgrass, sideoats grama, little bluestem, blue grama, and crested, pubescent, or intermediate wheatgrass. The seedbed should be firm and as free as possible of competition from perennial plants. The clean, firm stubble of sorghum or millet is suitable as a seedbed. Plant residue or stubble on the surface can help to reduce soil blowing and water erosion. For best results, seeding should take place early in spring.

Wildlife habitat, especially for rangeland wildlife, is an important secondary use for this soil. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is suited to windbreaks and environmental plantings. Sites need to be carefully selected and special practices need to be used in planting. Site preparation includes construction of level terraces a year in advance in which to plant the trees. Weeds on the terraces need to be controlled before and after planting. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to use as homesites and septic tank filter fields. Special design is required in some areas because of the moderately steep slopes. Because of the low bearing strength of the soil, foundation footings for houses should be wide enough to provide a safety margin of support for the weight of the building.

Capability subclass VIe, nonirrigated and irrigated.

12—Colby-Torriorthents complex, gullied, 15 to 25 percent slopes. This complex consists of deep, well drained, moderately steep soils on dissected slopes. These soils formed in calcareous loess. The areas of this complex are in the southeastern part of the county and are as much as 1,500 acres in size.

Colby silt loam makes up about 50 percent of this complex, Torriorthents 40 percent, and Haverson loam 10 percent. Haverson loam is a nearly level soil on the bottom of gullies.

Typically, the surface layer of the Colby soil is light brownish gray silt loam about 8 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous silt loam. In places, the surface layer is fine sandy loam.

Permeability is moderate. The available water capacity is high. Surface runoff is medium. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

The Colby soil is used as rangeland.

Torriorthents consist of gullied silty material. They are dissected by large gullies that have numerous short lateral branches. The large main gully, which is U-shaped, has been stabilized with grasses; the bottom of this gully is nearly level and is as much as 200 feet wide. The lateral branches are 25 to 300 feet long and about 6 feet deep. They are 50 to 300 feet apart.

Permeability and the available water capacity of Torriorthents are variable. Surface runoff is rapid. Water erosion is a very severe hazard, and soil blowing is a moderate hazard.

The potential native vegetation on the Colby soil is dominantly sideoats grama, little bluestem, western wheatgrass, and blue grama. If the range is continuously overgrazed, western wheatgrass, little bluestem, and sideoats grama tend to decrease, and blue grama, buffalograss, sedges, and native forbs including yucca, broom snakeweed, and cactus tend to increase. Blue grama and buffalograss will form a low-producing sod. Grazing management, including deferred grazing, is effective in restoring the potential of overused range. The use of machinery is not feasible on these soils because of the steep slopes.

Wildlife habitat, especially for rangeland wildlife, is an important secondary use for these soils. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities and by properly grazing livestock.

These soils are very poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine if plantings are feasible.

These soils generally are not well suited to use as homesites and sanitary facilities because of the steep slopes and gullies. Sites can be located on the gentle slopes. Because of the low bearing strength of the soil, foundation footings for houses need to be wide enough to provide a safety margin of support for the weight of buildings.

Capability subclass VIIe, nonirrigated.

13—Dailey loamy sand. This is a deep, somewhat excessively drained, nearly level to gently undulating soil on sandhills and in sandhill valleys. It formed in wind-deposited sand. The areas of this soil range to 600 acres in size.

Included in the mapped areas is Haxtun loamy sand in slightly concave positions. This soil makes up about 5 percent of the map unit.

Typically, the surface layer is grayish brown and dark grayish brown loamy sand about 12 inches thick. The layer below that is brown and pale brown loamy sand to a depth of about 36 inches. The underlying material, to a depth of 60 inches or more, is pale brown sand. In places, the surface layer is 20 or more inches thick.

Permeability is rapid. The available water capacity is low. Surface runoff is slow. The effective rooting depth is more than 60 inches. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 90 percent of the acreage of this map unit is used for grazing. The rest is irrigated cropland.

This soil is only marginally suited to use as irrigated cropland. Because of droughtiness and the severe soil blowing hazard, it is unsuited to use as nonirrigated cropland.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil fertility. Crop residue left standing or lying on the surface can control soil blowing when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can prevent damage to emerging seedlings by soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water on this sandy soil make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, are needed for optimum yields.

The potential native vegetation on this soil includes blue grama, sand bluestem, switchgrass, and prairie sandreed. Deterioration will cause sand bluestem, prairie sandreed, and switchgrass to decrease; blue grama and sand sagebrush will increase. Undesirable weeds and annual plants invade and increase in number as the range condition deteriorates. Deferred grazing is an effective range management practice. Seeding is recommended if the range is in poor condition. A mixture selected from sand bluestem, little bluestem, sideoats grama, Indian ricegrass, prairie sandreed, or switchgrass, interseeded at recommended rates for pure live seed, can improve the range condition. After seeding, grazing should be deferred until the end of the second growing season.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope,

can be encouraged by developing livestock watering facilities, by properly grazing livestock management, and by range seeding, where needed. Openland wildlife can be encouraged by establishing windbreaks to provide cover. Cotoneaster, sand cherry, and similar shrubs can provide food.

This soil is fairly well suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. These limitations can be overcome by planting trees in shallow furrows and by maintaining a vegetative cover between the rows. Supplemental irrigation is needed to insure survival. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as homesites and septic tank filter fields. Soil blowing can be a problem on construction sites.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

14—Dwyer-Vona loamy sands, 3 to 9 percent slopes. This map unit consists of moderately steep sandy soils on low sandhills and along major drainageways in the southeastern part of the county. These soils formed in eolian sand. The mapped areas range to 1,000 acres in size. The Dwyer soil makes up about 60 percent of this map unit, and the Vona soil makes up about 25 percent.

Included in mapping and making up about 10 percent of this unit are Manter loamy sand and Dailey loamy sand in swales and drainageways.

The Dwyer soil is deep and excessively drained. Typically, the surface layer is pale brown loamy sand about 12 inches thick. The layer below that is calcareous, very pale brown loamy fine sand about 18 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown fine sand.

Permeability is rapid. The effective rooting depth is more than 60 inches. The available water capacity is low. Surface runoff is slow. Soil blowing is a severe hazard, and water erosion is a slight hazard.

The Vona soil is deep and well drained. Typically, the surface layer is grayish brown loamy fine sand about 18 inches thick. The subsoil is brown fine sandy loam about 16 inches thick. The substratum, to a depth of about 45 inches, is white, calcareous very fine sandy loam. Below that, to a depth of 60 inches or more, it is very pale brown loamy fine sand.

Permeability is moderately rapid. The effective rooting depth is more than 60 inches. The available water capacity is moderate. Surface runoff is slow. Water erosion and soil blowing are severe hazards.

These soils are used mainly for grazing. They are marginally suited to use as irrigated cropland.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be controlled by leaving crop residue standing on the soil when crops are not grown. Seeding directly into the crop residue can help to protect emerging seedlings from damage by soil blowing. Grasses and legumes grown in rotation up to half of the time helps to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps to reduce the hazard of soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water make the most effective use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers if irrigation is excessive due to inadequate management or improperly maintained irrigation equipment. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, are needed for profitable yields.

The potential native vegetation on the Dwyer soil is dominantly sand bluestem, prairie sandreed, sand sagebrush, switchgrass, and blue grama. Deterioration of the range condition causes prairie sandreed, sand bluestem, and switchgrass to decrease in number and blue grama, sand sagebrush, and annual grasses to increase.

The potential native vegetation on the Vona soil is dominantly blue grama, prairie sandreed, and needleandthread. Continuous heavy grazing causes prairie sandreed and needleandthread to decrease and blue grama, sand sagebrush, bush wild buckwheat, sand dropseed, and annual grasses to increase.

Deferred grazing and sagebrush management, if needed, are effective in maintaining rangeland on these soils. Rangeland in poor condition can be improved by interseeding with a mixture selected from sand bluestem, little bluestem, sideoats grama, blue grama, switchgrass, indiangrass, and intermediate, pubescent, or crested wheatgrass. Seeding should be done at the rates recommended for pure live seed. New grass plantings should be protected from grazing until the end of the second growing season.

Rangeland wildlife, including antelope, cottontail, coyotes, and scaled quail, are the best adapted to these droughty soils. Forage production typically is low, and proper livestock grazing management is necessary if wildlife and livestock are to share the range. Livestock watering facilities, which are used by some wildlife, need to be established to improve the habitat. On irrigated land, openland wildlife can be encouraged if food and cover are provided through tree and shrub plantings and other habitat improvements.

These soils are fairly well suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. This limitation can be overcome by planting trees in shallow furrows and by maintaining vegetation between the rows. Supplemental irrigation is needed to insure survival of the plantings.

The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

These soils are well suited to use as homesites and septic tank filter fields; however, soil blowing can be a problem on construction sites.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

15—Eckley gravelly sandy loam, 3 to 7 percent slopes. This is a deep, well drained soil on ridges and low hills parallel to dry creekbeds. They are in the northwestern and south-central parts of the county. It formed in gravelly old alluvium of high dissected terraces. The areas of this soil generally are long and narrow and range to 80 acres in size.

Included in the mapped areas is Ascalon sandy loam. This soil makes up as much as 15 percent of the map unit.

Typically, the surface layer is grayish brown gravelly sandy loam about 5 inches thick. The subsoil is dark gravelly sandy clay loam about 10 inches thick. The substratum, to a depth of 60 inches or more, is light brown and pink gravelly sand. In some areas, the subsoil is gravelly sandy loam. In places, the substratum is about 2 1/2 feet thick and has finer textured material in the lower part. In some areas on cropland, the surface layer has been lost through erosion, and the gravelly sandy clay loam subsoil is being tilled.

Permeability is moderate in the subsoil and very rapid in the gravelly substratum. The available water capacity is low. Surface runoff is medium. Water erosion is a slight hazard, and soil blowing is a moderate hazard. The effective rooting depth is more than 60 inches.

About two-thirds of the acreage of this map unit is used for nonirrigated winter wheat. The rest is rangeland. This soil is only marginally suited to use as cropland, irrigated or nonirrigated, because the available water capacity is low. It is fair as a source of sand and gravel.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and, where suitable, contour stripcropping. A cropping system of grain sorghum alternated with wheat provides a protective cover of crop residue at all times, which is desirable because this soil is droughty.

The potential native vegetation is dominantly sideoats grama, blue grama, little bluestem, and needleandthread. Continuous overgrazing causes sideoats grama, little bluestem, and needleandthread to decrease and causes blue grama, sand sagebrush, sand dropseed, sedges, loco, and wormwood sage to increase and be invaded by annual weeds.

Badly deteriorated range can be improved or cultivated fields converted to grass by seeding at recommended rates with a mixture selected from sand bluestem, sideoats grama, switchgrass, and little bluestem. The range potential of this soil can be preserved through grazing management, which includes deferring grazing during some growth periods.

Rangeland wildlife, including antelope, cottontail, coyote, and scaled quail, are the best adapted to this droughty soil. Forage production is typically low, and proper livestock grazing management is necessary if wildlife and livestock are to share the range. Livestock watering facilities, which are used by wildlife, need to be established to improve the habitat.

This soil is poorly suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. These limitations can be overcome by planting trees in shallow furrows and by maintaining vegetation between the rows. Supplemental irrigation is needed to insure survival. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as homesites and septic tank filter fields.

Capability subclass IVe, nonirrigated and irrigated.

16—Glenberg-Bankard complex. This complex consists of nearly level soils on second-bottom terraces and flood plains of the Republican and Arikaree Rivers. These soils formed in recent alluvium. They are subject to rare or occasional flooding of very brief duration. The areas of this complex generally are elongated and range to 80 acres in size. The Glenberg soil makes up about 70 percent of this complex, and the Bankard soil makes up 30 percent.

The Glenberg soil is deep and well drained. Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The layer below that is light brownish gray fine sandy loam about 16 inches thick. The underlying material is light gray fine sandy loam to a depth of 60 inches or more. In some places, the surface layer is loamy sand. In other places, sand or gravelly sand is below a depth of 40 inches.

Permeability is moderately rapid. The effective rooting depth is more than 60 inches. The available water capacity is moderate. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

The Bankard soil is deep and somewhat excessively drained. Typically, the surface layer is pale brown sandy loam about 19 inches thick. The underlying material, to a depth of 60 inches or more, is very pale brown, calcareous gravelly sand.

Permeability is moderately rapid in the surface layer and very rapid in the underlying material. The effective rooting depth is more than 60 inches. The available water capacity is low. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 60 percent of the acreage of this soil complex is irrigated cropland. The rest is used for grazing and, to a

minor extent, as nonirrigated cropland. The principal irrigated crops are corn, alfalfa, and sorghum. Small grains and sorghum are the main nonirrigated crops. These soils are only marginally suited to nonirrigated crops because of droughtiness and the hazard of soil blowing.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in the soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Seeding directly into the crop residue can help to protect emerging seedlings from damage by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore the organic matter lost through soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential practices are stubble mulch tillage and stripcropping. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue, which helps reduce soil blowing and trap snow. The soil needs a protective cover at all times. Row crops grown annually or alternated with small grains can provide protective residue.

The potential native vegetation is dominantly needleandthread, prairie sandreed, switchgrass, and sand bluestem. Continuous heavy grazing causes these grasses to decrease and causes blue grama, sand sagebrush, and annual grasses and forbs to increase. Stocking at the proper rate and deferring grazing can prevent this deterioration.

Badly depleted rangeland can be improved by brush management and by seeding with a mixture selected from sand bluestem, prairie sandreed, switchgrass, and indiangrass in a prepared seedbed that has a nurse crop.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for these soils. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. The Glenberg soil can be used for plantings of trees and shrubs for wildlife cover and food. The Bankard soil is too droughty for this use. In general, the trees and shrubs recommended for use in windbreaks are suitable in developing wildlife habitat. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

The Glenberg soil generally is well suited for windbreaks and environmental plantings. Competition from grasses and weeds is the principal limitation to establishing trees and shrubs. In places, flooding is a hazard. Site preparation on the Glenberg soil includes planting cover crops such as sorghum, small grains, or sudangrass in the summer before trees are to be planted. Seeding cover crops between the rows of newly planted trees can provide protection for trees and shrubs against soil blowing. Weeds need to be controlled to insure the establishment of plantings. Supplemental irrigation may be needed. The trees that are best adapted are Rocky Mountain juniper, ponderosa pine, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian plum. The Bankard soil generally is poorly suited to windbreaks and environmental plantings because of droughtiness.

This soil is poorly suited to use as homesites because of the hazard of flooding.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

17—Haverson loam. This is a deep, well drained, nearly level loamy soil in swales on flood plains, and on second-bottom terraces of creeks, mainly in the southern part of the county. This soil formed in loamy, calcareous recent alluvium. The areas of this soil generally are elongated and range to 400 acres in size.

Included in mapping are areas of Glenberg fine sandy loam and Bankard sandy loam, which make up as much as 10 percent of this map unit, and areas of Las Animas fine sandy loam, which make up as much as 5 percent.

Typically, the surface layer is pale brown, calcareous loam about 4 inches thick. The layer below that is light brownish gray, calcareous loam about 10 inches thick. The underlying material, to a depth of about 36 inches, is grayish brown, calcareous loam. Below that, to a depth of 60 inches or more, it is light brownish gray, calcareous silty clay loam.

Permeability is moderate. The available water capacity is high. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard. This soil is occasionally or frequently flooded for a brief period. Salinity ranges from none to moderate.

Nearly all of the acreage of this map unit is rangeland. Some small areas are part of nonirrigated cropland used for winter wheat in a crop-fallow system. In some areas along the Republican River and Sand Creek, this soil is used for irrigated crops under furrow irrigation. The irrigated crops are alfalfa and corn.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth and fertility. Soil blowing can be controlled by leaving crop residue on the soil when crops are not grown. Soil tilth can be maintained by incorporating crop residue into the

surface layer, by subsoiling once every 3 or 4 years, and by minimizing tillage.

This soil is suited to furrow or border irrigation. Because of the moderate rate of water intake, the water must be applied slowly to avoid runoff and erosion, and enough water must be applied to moisten the soil fairly deep.

This soil is relatively fertile, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests should be consulted to determine the rate at which fertilizers should be applied. The hazard of the occasional or frequent overflow can damage crops. Low dikes can be constructed in some fields to prevent damage to crops by overflow.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. Soil blowing can be controlled and moisture conserved by using stubble mulch tillage and by stripcropping. Soil tilth can be maintained by incorporating crop residue into the soil and by subsoiling every 3 or 4 years to improve the permeability of the soil.

The potential native vegetation is dominantly blue grama, western wheatgrass, and green needlegrass. Continuous heavy grazing will cause western wheatgrass and green needlegrass to decrease; blue grama and buffalograss will increase, forming a sod, and undesirable plants will invade the plant population. Runoff and gully erosion increase on overgrazed rangeland. Chiseling, pitting, or contour furrowing help to reduce runoff.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. The trees and shrubs used in windbreaks are also suitable for improving wildlife habitat. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock water facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is well suited to windbreaks and environmental plantings. The hazard of flooding and competition from grasses and weeds are the principal limitations to establishing trees and shrubs. Summer fallow a year before planting and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Supplemental irrigation may be needed. The trees that are adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is poorly suited to use as homesites because of the flooding hazard.

Capability subclass IIIw, nonirrigated, and IIw, irrigated.

18—Haxtun loamy sand. This is a deep, well drained, sandy soil mainly in swales and sandhill valleys in the southern and north-central parts of the county. This soil formed in eolian sand that overlies an older buried soil. The areas range to 500 acres in size. Slopes are mainly 0 to 3 percent but range to 5 percent in some small areas.

Included in mapping are Dailey loamy sand, which makes up about 5 percent of this map unit, and Manter loamy sand, which makes up about 10 percent.

Typically, the surface layer is grayish brown loamy sand about 10 inches thick. The upper part of the subsoil is dark grayish brown sandy loam about 10 inches thick. The lower part is a buried subsoil of dark grayish brown sandy clay loam about 21 inches thick (fig. 2). The substratum, to a depth of 60 inches, is very pale brown, calcareous sandy loam. South of the Arikaree River, the substratum is calcareous coarse and medium sand below a depth of about 40 inches.

Permeability is moderate. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 60 percent of the acreage of this soil is cropland, most of which is irrigated. The rest is rangeland. The main crops are corn, small grains, sorghum, hay, and pasture grasses. This soil is well

Figure 2.—Profile of Haxtun loamy sand. A buried surface layer can be seen between the second and third arrows.

suited to irrigation, and good yields can be expected with proper management.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in the soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore the organic matter lost through soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving moisture. This soil is best suited to grain sorghum; however, small grains can also be grown. To help maintain the organic matter content and soil structure, an alfalfa-grass or grass mixture should be grown for 2 or 3 years and then alternated with annual crops. Crop residue can be left on the soil to reduce the hazard of soil blowing. Light applications of nitrogen fertilizer normally increase crop yields and the amount of crop residue produced. Crops should be planted at right angles to the prevailing wind, and the newly planted field should be left in a ridged condition. Ridges equivalent to those left by a deep furrow drill are most effective.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, little bluestem, and blue grama. If the range is overgrazed, these grasses decrease in number, and sand sagebrush, sand dropseed, and wild buckwheat increase. Undesirable weeds and annual plants invade and increase as the range condition deteriorates.

Badly depleted range can be improved by interseeding with a mixture selected from sand bluestem, sideoats grama, switchgrass, and indiangrass. Sand sagebrush management helps to increase production on overgrazed range.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed. Sand cherry, American plum, cotoneaster, and other species can provide food for openland wildlife. The trees and shrubs recommended for use in windbreaks can provide cover.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as sites for septic tank filter fields and houses. However, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings.

Capability subclass IIIe, nonirrigated and irrigated.

19—Haxtun sandy loam. This is a deep, well drained, loamy soil in upland swales and sandhill valleys throughout most of the survey area. This soil formed in mixed eolian and alluvial material overlying a buried soil. The areas are irregular in shape and range to 300 acres in size. The surface layer ranges from sandy loam to loam; the areas where this soil has a loam surface layer are in the northern part of the county.

Included in mapping and making up as much as 10 percent of this map unit are small areas of Ascalon sandy loam. This soil is in irregularly shaped areas on slightly convex slopes and is lighter in color than the Haxtun soil.

Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is grayish brown sandy clay loam about 13 inches thick. The lower part is a buried subsoil of very dark brown clay loam about 13 inches thick. The substratum, to a depth of 60 inches or more, is light brownish gray clay loam. It is calcareous below a depth of 54 inches.

Permeability is moderate. The available water capacity is high. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

More than 90 percent of the acreage of this map unit is cropland. On nonirrigated cropland, winter wheat is grown in a crop-fallow system. In some areas, this soil is used to grow corn and sugar beets.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining fertility. Soil blowing can be controlled by leaving crop residue on the surface when crops are not grown.

This soil is suited to sprinkler irrigation. Surface irrigation is feasible with some land leveling. High crop yields can be expected if irrigation is efficient; however, they can result in nutrient deficiencies. Soil tests should be consulted to determine the amount of fertilizer needed. Liberal applications of nitrogen and phosphorus

are needed where substratum material has been exposed by land leveling or erosion.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. Soil blowing can be controlled and moisture conserved by stubble mulch tillage and stripcropping. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue, which helps reduce soil blowing and trap snow. Nonirrigated cropland can be converted to grass by seeding a mixture selected from sand bluestem, sideoats grama, prairie sandreed, switchgrass, and indiangrass in a prepared seedbed or into the clean, firm stubble of sorghum or millet. After seeding, grazing should be deferred until the end of the second growing season.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as sites for septic tank filter fields and houses. However, because of the low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings.

Capability subclass IIe, nonirrigated and irrigated.

20—Iliff loam. This is a moderately deep, well drained soil in the northwestern part of the county. It formed in loess overlying limestone. The areas of this soil generally are rounded or oval and range to 300 acres in size.

Included in mapping and making up as much as 20 percent of this map unit are Canyon loam and Dioxice fine sandy loam, which are along the perimeter of the areas of this Iliff soil. A few small slickspots are included in areas of the Iliff soil.

Typically, the surface layer is grayish brown loam about 6 inches thick. The subsoil is dark grayish brown silty clay and pale brown silty clay loam about 12 inches thick. The substratum is very pale brown loam about 8 inches thick. Limestone bedrock is at a depth of about 26 inches.

Permeability is slow. The available water capacity is low. The effective rooting depth is 20 to 40 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

About 60 percent of the acreage of this map unit is cropland. In most areas, the cropland is used for nonirrigated winter wheat grown in a crop-fallow system. On a small acreage, the cropland is used for irrigated or nonirrigated corn. The rest of the map unit is rangeland.

On nonirrigated cropland used for wheat, soil blowing can be controlled by stubble mulching and stripcropping. Chiseling and minimum tillage help to maintain soil tilth.

Conservation practices on irrigated cropland include irrigation management, leaving crop residue on the surface, chiseling and subsoiling, minimum tillage, and growing grasses and legumes in rotation at least one-fourth of the time. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops.

The potential native vegetation is dominantly blue grama, buffalograss, western wheatgrass, and green needlegrass. Continuous heavy grazing will cause western wheatgrass and green needlegrass to decrease; blue grama and buffalograss will increase, forming a sod. Continued overuse will result in the invasion of red three-awn, broom snakeweed, cactus, fringed sagebrush, and others. Deferred grazing is effective in maintaining the condition of the range.

Badly depleted rangeland can be improved by interseeding with a mixture selected from western wheatgrass, sideoats grama, little bluestem, blue grama, and crested, pubescent, or intermediate wheatgrass. Seeds should be planted in a prepared seedbed early in spring.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and needs to be established, especially in areas of intensive agriculture. Wildlife can be encouraged by planting skunkbush sumac, lilac, Siberian peashrub, Rocky Mountain juniper, Russian-olive, and hackberry in selected areas. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock water facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is poorly suited to windbreaks and environmental plantings because of restricted rooting depth and the low water-holding capacity. Onsite investigations are needed if plantings are contemplated.

This soil is not well suited to use as homesites because of the high shrink-swell potential and the moderate depth to bedrock. The bedrock is rippable, using construction machinery. Backfilling foundations with coarser textured material will reduce the shrink-swell potential. The slow permeability in the subsoil and the moderate depth to bedrock also adversely affect septic tank absorption fields.

Capability subclass IVs, nonirrigated, and IIIs, irrigated.

21—Inavale loamy sand. This is a deep, somewhat excessively drained, nearly level sandy soil that formed in wind-reworked sand. This soil is in valley swales in sandhill areas, mainly in the northeastern part of the county. In a few small areas, this soil is on flood plains.

Slopes are less than 3 percent. The soil areas are generally elongated and up to 300 acres in size.

Included in mapping and making up as much as 20 percent of some mapped areas is Laird fine sandy loam. In some areas, a water table is at a depth of about 4 feet, mainly in wet years.

Typically, the upper part of the surface layer is grayish brown, calcareous loamy sand about 7 inches thick, and the lower part is light brownish gray, calcareous fine sandy loam and loamy sand about 9 inches thick. The underlying material, to a depth of about 38 inches, is light gray, calcareous loamy fine sand that has brownish yellow mottles; to a depth of 52 inches it is light brownish gray, calcareous loamy fine sand; and to a depth of 60 inches or more it is mottled, gray, calcareous, heavy sandy clay loam.

Permeability is rapid except in the lower part of the underlying material, where it is moderate. The available water capacity is moderate. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard. The water table is at a depth of more than 6 feet. Mottles in the soil indicate that the water table may have been at a lesser depth at one time. Flooding is possible where stream channels bisect the areas of this soil.

This soil is suitable for irrigated or nonirrigated hay and pasture grasses. About 70 percent of the acreage of this map unit is native rangeland, and 30 percent is used for irrigated alfalfa hay or for corn grown for grain or silage.

The main concern in managing irrigated cropland is controlling soil blowing. Leaving crop residue on the surface of the soil can help to reduce soil blowing. Because the surface layer of this sandy soil dries out quickly, frequent light applications of water are needed to establish hay or pasture grasses. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, can increase the yield of irrigated crops.

On nonirrigated pasture and hayland, the soil needs to be tested prior to planting to determine the amount of fertilizer needed. Soil blowing can be reduced by including a light seeding of small grains with pasture or hayland plantings during the initial growing season.

The potential native vegetation is dominantly sand bluestem, switchgrass, indiangrass, and prairie cordgrass. Continuous overgrazing will cause these grasses to decrease in the plant community, and western wheatgrass, alkali sacaton, inland saltgrass, Canada wildrye, and tall dropseed will increase. Sedges, rushes, foxtail, and horsetail also will increase. Deferred grazing and range seeding, where needed, help to maintain range in good condition.

Deteriorated rangeland can be improved by interseeding early in spring with a mixture of perennial grasses selected from intermediate grasses, switchgrass, and indiangrass. If this soil is used primarily for hay, some alfalfa and smooth bromegrass should be included in seeding. Grasses should not be grazed or harvested during the initial growing season.

Wildlife habitat can be developed in irrigated areas by planting trees and shrubs and by establishing undisturbed nesting cover of grasses and legumes. The trees and shrubs recommended for use in windbreaks can also provide cover and food for wildlife. If a water supply is available, waterfowl can be attracted to the area by developing shallow-water areas. This soil can provide habitat suitable for rangeland wildlife, including antelope and lark bunting.

The soil is fairly well suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. Trees should be planted in shallow furrows and a vegetative cover should be maintained between the rows. Supplemental irrigation is needed to ensure survival of the plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

The hazard of rare flooding limits the use of this soil for homesites. Onsite investigation is needed to determine the depth of the water table. If houses that have a basement are to be constructed, investigations should take place early in spring.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

22—Julesburg loamy sand, 0 to 3 percent slopes. This is a deep, well drained, sandy soil on smooth plains in the north- and south-central parts of the county. It formed in eolian sand. The areas of this soil are generally elongated and are up to 400 acres in size.

Included in the mapped areas are Haxtun loamy sand and Dailey loamy sand. These included soils make up as much as 25 percent of the map unit.

Typically, the surface layer is grayish brown loamy sand about 11 inches thick. The subsoil is brown fine sandy loam about 23 inches thick. The substratum, to a depth of 54 inches, is brown loamy sand and fine sandy loam. Below that, it is very pale brown, calcareous fine sandy loam or fine sand.

Permeability is moderately rapid in the subsoil and rapid below the subsoil. The available water capacity is moderate. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About three-fourths of the acreage of this map unit is rangeland. About one-fourth is used for irrigated corn, hay, and pasture grasses. In some places this soil was once dryfarmed but has been seeded back to grass.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in the soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch for emerging seedlings. Grasses and legumes grown in

rotation about one-fourth of the time help to restore the organic matter lost through soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizers are needed where substratum material has been exposed by soil blowing.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving moisture. This soil is best suited to grain sorghum; however, small grains can also be grown. To help maintain the organic matter content and soil structure, an alfalfa-grass or grass mixture should be grown for 2 or 3 years and then alternated with annual crops. Crop residue can be left on the soil to reduce the hazard of soil blowing. Light applications of nitrogen fertilizer normally increase crop yields and the amount of crop residue produced. Crops should be planted at right angles to the prevailing wind, and the newly planted field should be in a ridged condition. Ridges equivalent to those left by a deep furrow drill are most effective.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, sand sagebrush, and blue grama. Continuous heavy grazing will cause sand bluestem, switchgrass, and sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use of rangeland will cause annual grasses and weeds to invade.

Badly depleted rangeland can be improved by interseeding with a mixture selected from sand bluestem, sideoats grama, prairie sandreed, switchgrass, and indiangrass. After seeding, grazing should be deferred until the end of the second growing season. Nonirrigated fields can be seeded by drilling the grass seed in a clean, firm seedbed of sorghum or millet stubble. Other effective range management practices include deferred grazing and management of sand sagebrush.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. American plum, sand cherry, cotoneaster, and similar species can provide food. Trees and shrubs suitable for use in windbreaks can provide cover. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIIe, nonirrigated and irrigated.

23—Julesburg loamy sand, 3 to 7 percent slopes. This is a deep, well drained, gently undulating soil on smooth plains. It formed in eolian sand. The areas generally are elongated and range to 300 acres in size. They are mainly in the north- and south-central parts of the county.

Included in the mapped areas are Manter loamy sand, which makes up 30 percent of the map unit, and Dailey loamy sand, which makes up 10 percent.

Typically, the surface layer is grayish brown loamy sand about 11 inches thick. The subsoil is brown coarse sandy loam about 8 inches thick. The substratum, to a depth of 60 inches or more, is light yellowish brown sand.

Permeability is rapid. The available water capacity is low. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 60 percent of the acreage of this unit is used for grazing. The rest is used about equally for nonirrigated winter wheat and grain sorghum and for irrigated corn, hay, and pasture. This soil is poorly suited to use as nonirrigated cropland because of droughtiness and the severe soil blowing hazard.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be controlled by leaving crop residue as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch for emerging seedlings. Grasses and legumes grown in rotation up to half of the time helps to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps this soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water make the most efficient use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers. This problem can be prevented by avoiding overirrigation and by maintaining irrigation equipment in good condition. Fertilizers that add large quantities of nitrogen and phosphorus to the soil are needed for profitable crop

yields. Soil tests and anticipated yields should be used to estimate application rates.

The main concerns in managing nonirrigated cropland are controlling soil blowing and water erosion and conserving soil moisture. This soil is best suited to grain sorghum; however, small grains can also be grown. To help maintain the organic matter content and soil structure, an alfalfa-grass or grass mixture should be grown for 2 or 3 years and then alternated with annual crops. Crop residue can be left on the soil to reduce the hazards of soil blowing and water erosion. Minimizing tillage can help to preserve the crop residue. Light applications of nitrogen fertilizer normally increase crop yields and the amount of crop residue produced. Crops should be planted at right angles to the prevailing wind, and the newly planted field should be left in a ridged condition. Planting small grains in strips alternated with fallow or row crops can provide additional protection from soil blowing.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, sand sagebrush, and blue grama. Continuous heavy grazing by cattle will cause sand bluestem, switchgrass, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use of rangeland will cause annual grasses and weeds to invade.

Badly depleted rangeland can be improved by interseeding with a mixture selected from sand bluestem, little bluestem, sideoats grama, prairie sandreed, indiangrass, and switchgrass. Nonirrigated cropland can be converted to grass by drilling a seed mixture selected from these perennial grasses into a clean, firm seedbed of sorghum or millet stubble. Other effective range management practices include deferred grazing and management of sand sagebrush, where needed.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. In addition to those trees and shrubs suitable for use in windbreaks, sand cherry, cotoneaster, and similar species can provide food for openland wildlife. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil is fairly well suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. Trees should be planted in shallow furrows and a vegetative cover should be maintained between the rows. Supplemental irrigation is needed to insure survival of the plantings. The trees that are adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IVe, nonirrigated and irrigated.

24—Klm loam, 3 to 6 percent slopes. This is a deep, well drained soil on fans and foot slopes of the Republican and Arikaree Rivers. This soil formed in alluvium. The areas of this map unit are irregular in shape and range to 200 acres in size. They are in the east-central part of the county.

Included in mapping are areas of Bayard fine sandy loam, which makes up 15 percent of this map unit, and areas of Razor clay loam and Midway silty clay loam, which make up 5 percent.

Typically, the surface layer is light brownish gray and pale brown loam about 16 inches thick. The underlying material, to a depth of 60 inches or more, is light yellowish brown clay loam.

Permeability is moderate in the upper part of the soil and moderately slow in the lower part. The available water capacity is high. The effective rooting depth is 60 inches or more. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

About 50 percent of the acreage of this map unit is rangeland. About 30 percent is nonirrigated cropland, and about 20 percent is irrigated cropland. Nonirrigated cropland is used for winter wheat grown in a crop-fallow system. Corn and alfalfa are the main irrigated crops.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and tilth. Incorporating crop residue into the surface layer helps to control soil blowing, to improve soil tilth and water intake, and to reduce water erosion. Minimizing tillage also can help to maintain tilth and reduce erosion. This soil responds to applications of nitrogen fertilizer. Grasses and legumes grown in rotation about one-fourth of the time help to maintain tilth and fertility and to improve water intake.

This soil is best suited to sprinkler irrigation. Water must be applied slowly to avoid runoff and to moisten the soil fairly deep.

The main concerns in managing nonirrigated cropland are controlling water erosion and soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and stripcropping. Where slopes are long enough to permit their use, terracing and farming on the contour are effective in reducing runoff.

The potential native vegetation is dominantly blue grama, buffalograss, western wheatgrass, sedges, and green needlegrass. Continuous heavy grazing will cause western wheatgrass and green needlegrass to decrease;

blue grama and buffalograss will increase, forming a dense, low-producing sod, and undesirable plants will invade the plant community. Overgrazing rangeland increases runoff and erosion. Chiseling, pitting, and contour furrowing can help to reduce runoff.

Badly deteriorated range can be improved by seeding using a mixture selected from recommended varieties of western wheatgrass, little bluestem, sideoats grama, blue grama, and switchgrass. Seeds that are planted in a firm seedbed as free as possible of competition from perennial plants have the best chance of survival. Cultivated fields can be converted to pasture by seeding with a mixture selected from western wheatgrass, little bluestem, Russian wildrye, switchgrass, and sand lovegrass; the existing wheat stubble or a cover crop of millet is suitable as a seedbed.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed. In general, those trees and shrubs suitable in windbreak plantings can also provide good habitat for wildlife.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year prior to planting, supplemental water during planting and early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. The shrink-swell potential of the underlying material is a limitation to the use of this soil as a site for houses that have a basement. This shrinking and swelling can be reduced by keeping the soil around the foundation dry and by backfilling foundations with coarser textured material. Because of the moderately slow permeability of underlying material, septic tank filter fields need to be larger than typical.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

25—Kuma-Keith silt loams. These are nearly level or gently sloping soils on smooth plains mainly in the southeastern part of the county. The soils formed in loess. Mapped areas range to 2,000 acres in size.

In the Vernon area, the Kuma soil makes up about 55 percent of the map unit, the Keith soil 30 percent, and Colby silt loam 15 percent. In the Idalia area, where the soils are nearly level, the Kuma soil makes up 70 percent of the map unit, the Keith soil 25 percent, and the Colby soil 5 percent. Intermittently ponded areas 5 acres or less in size and a few larger ones average about 6 per square mile.

The Kuma soil is a deep, well drained soil that has a buried layer in the subsoil. Typically, the Kuma soil has a surface layer of grayish brown silt loam about 10 inches thick. The upper part of the subsoil is grayish brown silty clay loam about 7 inches thick. The buried layer in the lower part of the subsoil is dark grayish brown and pale brown silty clay loam about 13 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown silt loam and loam.

Permeability is moderately slow. The effective rooting depth is more than 60 inches. The available water capacity is high. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

The Keith soil is deep and well drained. Typically, the surface layer is grayish brown silt loam about 4 inches thick. The upper part of the subsoil is grayish brown silty clay loam about 11 inches thick, and the lower part is light brownish gray, calcareous silt loam about 10 inches thick. The substratum is very pale brown silt loam to a depth of 60 inches or more (fig. 3).

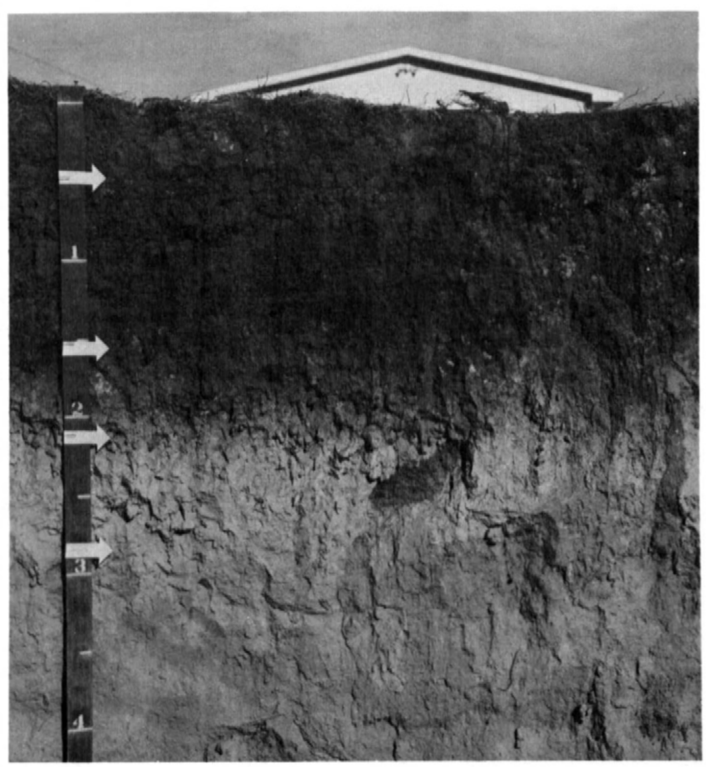


Figure 3.—Profile of Keith silt loam. The subsoil has medium prismatic structure.

Permeability is moderate. The effective rooting depth is more than 60 inches. The available water capacity is high. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

More than 95 percent of the acreage of this complex is cropland. Some cropland is irrigated, and some is not. Winter wheat grown in a crop-fallow sequence is the principal nonirrigated crop. Grain sorghum is also an important nonirrigated crop. Corn and sugar beets are the main irrigated crops.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth. Soil blowing can be controlled by leaving crop residue on the surface for protection when crops are not grown. Soil tilth can be maintained by incorporating crop residue into the surface layer, subsoiling once every 3 or 4 years, and minimizing tillage.

The soils are suited to sprinkler irrigation or surface application of irrigation water. In the vicinity of Idalia, the soils are level enough that furrows or the flooding method of irrigation can be used. Sprinklers, however, are also used. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep.

These are fertile soils, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests should determine the amount of fertilizer needed. Liberal applications of phosphorus and nitrogen fertilizers are needed where substratum material has been exposed by land leveling.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. The essential practices for controlling soil blowing and conserving moisture are stubble mulch tillage and stripcropping. Farming on the contour and terracing help reduce surface runoff and conserve water for crops (fig. 4). Soil tilth can be maintained by incorporating crop residue into the soil and by subsoiling every 3 or 4 years to improve soil permeability. Emergency tillage that leaves clods of soil on the surface helps control soil blowing in periods of wind and drought.

The potential native vegetation on these soils includes blue grama, buffalograss, western wheatgrass, sedge, and green needlegrass. Continuous heavy grazing will cause western wheatgrass and green needlegrass, vetch, and prairie clover to decrease; blue grama and buffalograss will increase, forming a dense low-producing sod. Continued overuse will result in the invasion of red three-awn, broom snakeweed, cactus, fringed sagebrush, and other annuals. Deferred grazing is effective in restoring the potential of overused range. Mechanical practices in areas of gently sloping soils help to reduce runoff.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for these soils.

Figure 4.—Flat channel terraces in an area of Kuma-Keith silt loams.

Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. Trees and shrubs used in windbreaks can also be used as habitat for openland wildlife.

The soils making up this map unit generally are well suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

These soils are suited to use as homesites, but, because of the low bearing strength of the soils, foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. Backfilling foundations with coarser textured material can reduce the effects of soil shrinking and swelling. The Kuma soil has a moderate limitation for use as septic tank filter fields because of slow permeability. Leach lines have to be more extensive than typical.

Capability subclass IIc, nonirrigated, and IIe, irrigated.

26—Laird fine sandy loam. This is a deep, well drained soil in swales in sandhill valleys. This soil formed in wind-reworked alluvium. The areas generally are rounded and range to 200 acres in size. They are mainly in the northeastern part of the county.

Included in mapping are Haxtun loamy sand, which makes up about 10 percent of this map unit, and Dailey loamy sand, which makes up less than 5 percent.

Typically, the surface layer is grayish brown and light brownish gray fine sandy loam about 27 inches thick. The underlying material, to a depth of about 46 inches, is light gray very fine sandy loam and has abundant calcium and magnesium salts and some snail shells; to a depth of 60 inches or more, the underlying material is light gray loamy fine sand.

Permeability is moderate to a depth of 40 inches or more and is rapid below that. The available water capacity is moderate. The effective rooting depth is more than 60 inches. The underlying material is moderately alkaline to strongly alkaline. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

In many areas, this soil is used for crops. It is poorly suited to use as nonirrigated cropland because of the severe soil blowing hazard. About 50 percent of the acreage of this soil is irrigated cropland. The salts in this soil tend to stunt the growth of cover and turn it yellow.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining fertility. Soil blowing can be controlled by leaving crop residue on the surface when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can prevent damage to emerging seedlings by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help restore organic matter lost by soil blowing. Decomposition of organic matter has a stabilizing effect that helps the soil resist soil blowing.

This soil is suited to sprinkler irrigation. Surface irrigation is feasible with some land leveling. Fertilizers that add nitrogen and phosphorus to the soil are needed for optimum yields. Iron and possibly zinc need to be added to the soil to prevent yellowing and stunted growth. Soil tests can help to determine the amount of fertilizer needed.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving moisture. This soil is best suited to grain sorghum; however, small grains can also be grown. To help maintain the organic matter content and soil structure, an alfalfa-grass or grass mixture should be grown for 2 or 3 years and then alternated with annual crops. Crop residue can be left on the surface to reduce the hazard of soil blowing. Light applications of nitrogen fertilizer normally increase crop yields and the amount of crop residue produced. Crops should be planted at right angles to the prevailing wind, and the newly planted fields should be left in a ridged condition. Ridges equivalent to those left by a deep furrow drill are most effective.

The potential native vegetation on this soil is dominantly needleandthread, switchgrass, little bluestem, indiangrass, and western wheatgrass. Overgrazing the range will cause indiangrass, switchgrass, western wheatgrass, and needleandthread to decrease in the plant community, and saltgrass and sand dropseed will increase. Proper grazing use and deferred grazing can maintain the productive potential of the range.

Badly deteriorated range or cropland can be reseeded with a mixture selected from recommended varieties of little bluestem, sideoats grama, blue grama, prairie sandreed, switchgrass, and indiangrass. These grasses should be seeded in a firm seedbed as free as possible of competition from perennial plants or in the clean, firm stubble of sorghum or millet. For best results, seeding should take place early in spring. After seeding, grazing should be deferred for two growing seasons to insure the establishment and survival of seedlings.

This soil has good potential for the development of habitat for openland wildlife, including pheasant, cottontail, mourning dove, and songbirds, especially in areas under irrigation where a variety of crops and cover types can be grown. The habitat for openland wildlife can be improved by planting trees and shrubs and by establishing undisturbed nesting cover. Windbreaks can also be established to improve the habitat for openland wildlife. Rangeland wildlife, including antelope, jackrabbit, lark bunting, and horned lark, can be encouraged on

grasslands by good livestock grazing management, by fencing to permit the free movement of antelope, and by developing livestock watering facilities.

This soil generally is suited to windbreaks and environmental plantings. The hazard of soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIIe, nonirrigated and irrigated.

27—Las Animas fine sandy loam. This is a deep, poorly drained, nearly level soil on flood plains of the Republican and Arikaree Rivers. It formed in recent alluvium. The areas of the soil are elongated and range to 600 acres in size. Slopes are no more than 2 percent.

Included in mapping are areas of Glenberg fine sandy loam and Bankard sandy loam, which make up about 15 percent of this map unit, and areas of Platte fine sandy loam, which make up about 5 percent.

Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The underlying material, to a depth of about 34 inches, is light gray sandy loam; to a depth of about 51 inches, it is gray coarse sandy loam; and to a depth of 60 inches or more, it is gray coarse sand.

Permeability is moderately rapid. The available water capacity is moderate. The salinity of the surface layer varies from place to place and ranges from low to high. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard. The water table is at a depth of about 18 inches. This soil is occasionally flooded for a brief period.

Most of the acreage of this map unit is native rangeland. Some small areas are part of cultivated fields. This soil is only moderately well suited to use as cropland because of wetness and salinity.

The main concerns in managing irrigated cropland include controlling soil blowing and reducing the salt content. Soil blowing can be controlled by leaving crop residue on the surface when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can prevent damage to emerging seedlings by soil blowing. This soil is best suited to salt-tolerant crops, barley, sugar beets, or tall wheatgrass for pasture.

This soil is best suited to sprinkler irrigation, but surface irrigation is feasible with land leveling. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. The salt content in the surface layer can be reduced by irrigating more than is normal for this soil and for the crops grown. This should be done annually with the first irrigation and perhaps more often because salts tend to accumulate in the surface as water evaporates.

On nonirrigated cropland, this soil is best suited to barley and grain sorghum. The soil needs to be protected from soil blowing throughout the year. Leaving crop residue as standing stubble when crops are not grown and stripcropping can help to control soil blowing. Cropland can be converted to grass by seeding with a mixture selected from western wheatgrass, tall wheatgrass, slender wheatgrass, switchgrass, or alkali sacaton.

The potential native vegetation on this soil is dominantly sacaton, switchgrass, western wheatgrass, inland saltgrass, sedges, and Baltic rush. Overgrazing the range will cause alkali sacaton, switchgrass, and western wheatgrass to decrease in the plant community, and inland saltgrass, alkali bluegrass, foxtail barley, rushes, sedges, and forbs will increase.

Range in poor condition can be improved by seeding. A mixture of big bluestem, switchgrass, indiangrass, or singly, western wheatgrass, intermediate, or tall wheatgrass can be used in seeding. A proper seedbed must be prepared.

Wildlife habitat is an important use for this soil because of its proximity to the Arikaree and Republican Rivers. On cropland, wildlife such as waterfowl, pheasant, and deer utilize the crop residue. Wildlife habitat can be improved on this soil by planting trees and shrubs and establishing undisturbed nesting cover of grasses and legumes. Waterfowl can be attracted to the area by developing shallow-water areas.

On nonirrigated land, this soil can provide habitat for antelope, lark bunting, and other rangeland wildlife. The trees and shrubs recommended for use in windbreaks can be established to improve the habitat for openland wildlife.

This soil generally is well suited to windbreaks and environmental plantings. Poor drainage and the abundant and persistent vegetation are the principal limitations to establishing trees and shrubs. Continued cultivation for weed control and careful plant selection are needed to insure the survival of plantings. The trees that are best adapted and that have a good chance of survival are Russian-olive and Rocky Mountain juniper; the shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

This soil is poorly suited to use as homesites because of the flood hazard and wetness.

Capability subclass IIIw, nonirrigated and irrigated.

28—Las Animas loam. This is a deep, poorly drained soil on flood plains along the North Fork of the

Republican River. It formed in recent alluvium that washed from the limestone breaks to the south and from the sandhills to the north. The areas are elongated, parallel to the river, and range to 200 acres in size.

Included in mapping and making up about 15 percent of the map unit are small areas of Platte fine sandy loam in oxbows of streams.

Typically, the surface layer is grayish brown, calcareous loam about 7 inches thick. The underlying material, to a depth of 60 inches or more, is stratified fine sandy loam, sandy loam, and sandy clay loam. In places, coarse sand is at a depth of about 40 inches.

Permeability is moderately rapid. The available water capacity is moderate. Surface runoff is slow. Water erosion and soil blowing are slight hazards. The depth to the water table is about 18 inches. The salinity of the surface layer varies from place to place and ranges from low to moderate. Brief flooding occurs occasionally.

This soil is used almost exclusively as rangeland and for wildlife habitat.

The potential native vegetation is dominantly switchgrass, indiangrass, big bluestem, western wheatgrass, and prairie cordgrass. Sedges and rushes generally are understory plants on this soil but are not prominent except where water is at or very near the surface throughout the year. Other grasses and perennial forbs and some shrubby species such as wild rose are scattered on this soil. Cattails and bullrushes are in swampy areas. The ground cover is 60 percent or more. It is uniform and has no bare spots except where water stands on the surface during much of the year. The tall grasses are thrifty and productive and produce an abundance of litter.

Proper grazing use maintains range in good condition. Continuous overgrazing will cause switchgrass, big bluestem, and indiangrass to decrease in number. Production can be improved by applying nitrogen fertilizer. Range in extremely poor condition can be improved by reseeding with a mixture of big bluestem, switchgrass, and indiangrass, or, singly, with western, intermediate, or tall wheatgrass. A proper seedbed must be prepared.

Wetland wildlife, especially waterfowl, inhabit these areas because of the moisture due to the wetness of this soil. The habitat for wetland wildlife can be improved by excavating or pothole blasting to establish open-water areas. Livestock grazing should be carefully managed to maintain the cover for waterfowl. The trees and shrubs recommended for use in windbreaks can be established to enhance wetland wildlife reproduction.

This soil generally is well suited to windbreaks and environmental plantings. The poor soil drainage and the abundant and persistent vegetation are the principal limitations to establishing trees and shrubs. Summer fallow, continued cultivation for weed control, and careful plant selection are needed to insure the survival of plantings. The trees that are best adapted and that have a good chance of survival are eastern cottonwood, golden willow, blue spruce, and Rocky Mountain juniper; the shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

This soil is poorly suited to use as homesites because of wetness and the hazard of flooding.

Capability subclass Vw, nonirrigated.

29—Manter loamy sand. This is a deep, well drained, nearly level soil on smooth plains. It formed in eolian sand. The areas of this soil are irregular in shape and range to 500 acres in size. Slopes generally are less than 2 percent.

Included in the mapped areas is Haxtun loamy sand, which makes up as much as 20 percent of this map unit.

Typically, the surface layer is grayish brown loamy sand about 6 inches thick. The subsoil is dark brown sandy loam about 15 inches thick. The substratum, to a depth of 60 inches, is light gray, calcareous loamy sand. In the northeastern part of the county, the substratum is light gray loam underlain by light gray fine sandy loam.

Permeability is moderately rapid. The available water capacity is moderate. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 75 percent of the acreage of this soil is land that was once or is now used as nonirrigated cropland. In many areas, this land has been reseeded to grass or has been converted to irrigated cropland, pasture, or hayland. The rest of the acreage is rangeland.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in this soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that can help to prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore organic matter lost by soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizers are needed where substratum material has been exposed by land leveling or erosion. On irrigated land, inland saltgrass tends to invade areas that are not regularly cultivated. Corn may have yellowing leaves, which is a sign of iron chlorosis.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving moisture. This soil is best suited to grain sorghum; however, small grains can also be grown. To help maintain the organic matter content and soil structure, an alfalfa-grass or

grass mixture should be grown for 2 or 3 years and then alternated with annual crops. Crop residue can be left on the surface to reduce the hazard of soil blowing. Light applications of nitrogen fertilizer normally increase crop yields and the amount of crop residue produced. Crops should be planted at right angles to the prevailing wind, and the newly planted field should be left in a ridged condition. Ridges equivalent to those left by a deep furrow drill are most effective.

The potential native vegetation on this soil is dominantly prairie sandreed, sand bluestem, switchgrass, blue grama, and needleandthread. Continuous heavy grazing will cause sand bluestem, needleandthread, switchgrass, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extremely heavy use will cause annual weeds and grasses to invade. The range potential on this soil can best be realized through sand sagebrush management, deferred grazing, and seeding, where needed. Badly depleted native grassland can be improved by interseeding. Nonirrigated cropland can be converted to grass by seeding with a mixture selected from the wheatgrasses, sand bluestem, switchgrass, and indiangrass. The clean, firm stubble of sorghum or millet is suitable as a seedbed. For best results, seeding should take place early in spring.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed. The trees and shrubs suitable for use in windbreaks can provide cover for wildlife. Sand cherry, caragana, cotoneaster, and similar species can provide food.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIIe, nonirrigated and irrigated.

30—Manter sandy loam, 2 to 5 percent slopes. This is a deep, well drained, nearly level to gently sloping soil on smooth plains near the sandhills. It formed in eolian sand. Mapped areas range to 300 acres in size.

Included in mapping are Ascalon sandy loam, which makes up about 5 percent of the map unit, and Julesburg loamy sand, which also makes up about 5 percent. The Ascalon soil is on the concave part of slopes, and the Julesburg soil is on ridges.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is grayish brown and brown sandy loam about 22 inches thick. The substratum, to a depth of more than 60 inches, is very pale brown sandy loam.

Permeability is moderately rapid. The available water capacity is moderate. The effective rooting depth is more than 60 inches. Surface runoff is medium. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About 60 percent of the acreage of this map unit is cropland, and about 40 percent is rangeland or grassland that has been converted from cropland. Grain sorghum and wheat are the main nonirrigated crops. Winter wheat commonly is grown in a crop-fallow system. Some of the cropland is used for irrigated corn or alfalfa.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in the soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that helps to prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore organic matter lost through soil blowing. Decomposition of organic matter in the soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizer are needed where substratum material has been exposed by erosion.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are leaving crop residue on the soil (fig. 5), stubble mulch tillage, and stripcropping. A cropping system of row crops grown annually or alternated with wheat helps to better protect the soil from soil blowing and washing; however, yields may be less. Where slopes are long enough to permit their use, terracing and farming on the contour can reduce runoff and conserve water. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue, which helps reduce soil blowing and trap snow.

Figure 5.—In this area of Manter sandy loam, 2 to 5 percent slopes, the crop residue is left standing to help control soil blowing.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. Continuous heavy grazing will cause sand bluestem, switchgrass, needleandthread, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use will cause annual weeds and grasses to invade.

The range potential on this soil can be best realized by deferred grazing, managing sand sagebrush, and range seeding, where needed.

Nonirrigated fields converted to grass or range that is in poor condition can be improved by seeding with a mixture selected from crested, pubescent, or intermediate wheatgrass; sand bluestem; switchgrass; and indiangrass. For best results, a proper seedbed should be prepared. However, timely seeding into stubble or a cover crop can produce satisfactory results and helps to control erosion.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover.

This soil is well suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass IIIe, nonirrigated and irrigated.

31—Manter sandy loam, 5 to 9 percent slopes. This is a deep, well drained, sloping soil on smooth plains in the central and southern parts of the county. It formed in eolian sand. Mapped areas range to 200 acres in size. Slopes range from 5 to 9 percent but are mainly less than 7 percent.

Included in mapping and making up as much as 25 percent of this map unit are areas of Bayard fine sandy loam on ridges or on the convex, upper part of slopes. Of minor extent in the unit is Eckley gravelly sandy loam, which is in small areas along the valley of the Arikaree River in the southern part of the county.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is dark grayish brown sandy loam about 12 inches thick. The substratum, to a depth of more than 60 inches, is pale brown sandy loam.

Permeability is moderately rapid. The available water capacity is moderate. The effective rooting depth is more than 60 inches. Surface runoff is moderate. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

About 20 percent of the acreage of this map unit is sprinkler-irrigated cropland. The rest is used mainly as

rangeland. A few small areas are part of nonirrigated cropland, but this soil is not suited to nonirrigated crops because of the severe hazards of water erosion and soil blowing.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be minimized by leaving crop residue on the soil as standing stubble when crops are not grown. Crops can be seeded directly into crop residue, which serves as a protective mulch that helps to prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation up to half of the time help to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps this soil resist soil blowing.

This soil is suited only to sprinkler irrigation. Frequent light applications of water make the most efficient use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers. This problem can be prevented by avoiding overirrigation and by maintaining irrigation equipment in good condition. Fertilizers that add nitrogen and phosphorus to the soil are needed for profitable crop yields. Soil tests and anticipated yields should be used to estimate application rates.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. Continuous heavy grazing will cause sand bluestem, switchgrass, needleandthread, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use will cause annual weeds and grasses to invade. The range potential of this soil can best be realized by deferred grazing, managing sand sagebrush, and range seeding, where needed.

Range in poor condition can be improved or cropland can be converted to grass by seeding with a mixture selected from crested, pubescent, or intermediate wheatgrass; sand bluestem; sideoats grama; and switchgrass. A properly prepared seedbed and timely seeding are essential for satisfactory results.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Habitat for openland wildlife can be improved by planting drought-tolerant trees and shrubs. The trees and shrubs recommended for use in windbreaks on this soil can provide habitat for wildlife. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. This soil is well suited to use as septic tank filter fields.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

32—Paoli sandy loam. This is a deep, well drained soil on flood plains and second-bottom stream terraces in the northern part of the county. It formed in sandy recent alluvium. The areas of this soil are elongated and range to 200 acres in size. Slopes are less than 2 percent.

Included in mapping are small areas of Albinas loam and Bankard sand. These soils make up no more than 15 percent of any one mapped area.

Typically, the surface layer is grayish brown sandy loam about 32 inches thick (fig. 6). The underlying material, to a depth of 60 inches or more, is light brownish gray, calcareous coarse sandy loam. In places, a layer of gravelly sand several feet thick is below a depth of about 24 inches.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard. Brief periods of flooding occur rarely along some drainageways and occasionally along others.

This soil is used as rangeland and for nonirrigated wheat, sorghum, or corn. A cropping system of small grain-fallow or of row crops alternated with small grain-fallow is used on this soil.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and stripcropping. Light applications of nitrogen fertilizer normally result in larger amounts of crop residue, which helps to reduce soil blowing and trap snow. A cropping system of small grains alternated with row crops can provide a protective cover.

The potential native vegetation is dominantly sand bluestem, switchgrass, needleandthread, prairie sandreed, and blue grama. Continuous heavy grazing will cause sand bluestem, switchgrass, needleandthread, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use will cause annual weeds and grasses to invade. Effective range management practices are deferred grazing, sand sagebrush management, and range seeding, where needed.

Deteriorated rangeland can be improved by seeding

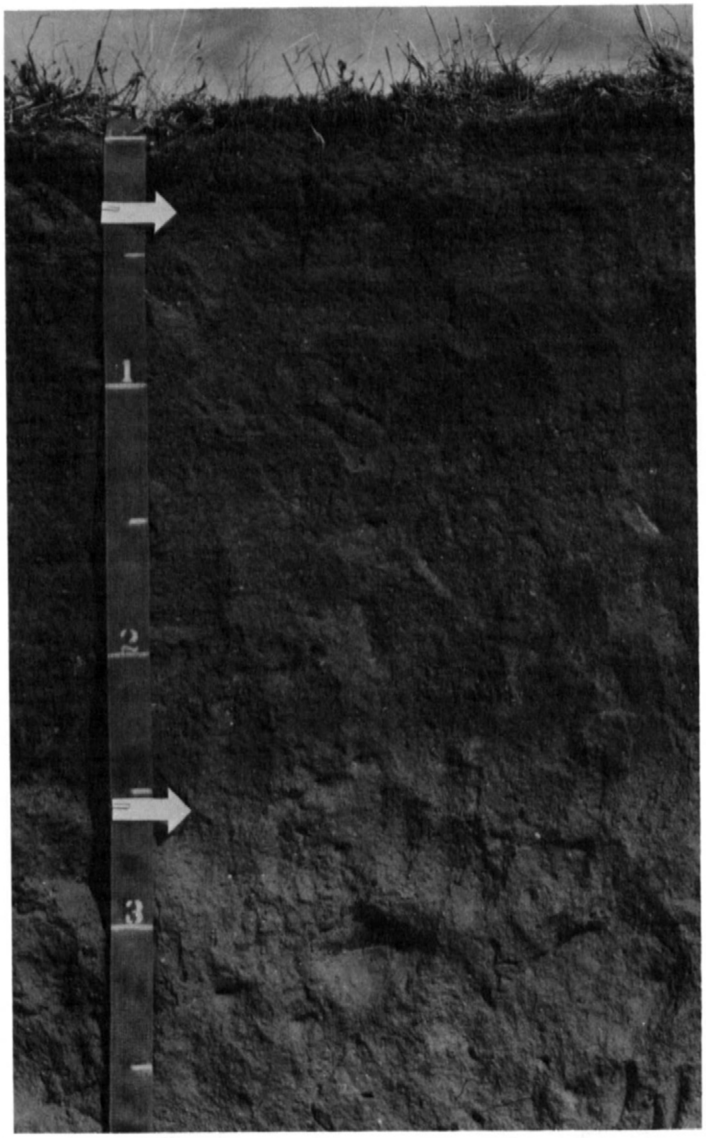


Figure 6.—Profile of Paoli sandy loam. The surface layer is 32 inches thick.

with a mixture selected from sand bluestem, little bluestem, sideoats grama, prairie sandreed, switchgrass, indiangrass, Indian ricegrass, and blue grama. Nonirrigated cropland can be converted to grass by seeding with a mixture selected from the wheatgrasses, sand bluestem, switchgrass, and indiangrass, into sorghum or millet stubble.

This soil has good potential for the development of habitat for openland wildlife, including pheasant, cottontail, mourning dove, and songbirds. The habitat for openland wildlife can be improved by planting the trees and shrubs recommended for use in windbreaks. Rangeland wildlife, including antelope, jackrabbit, lark bunting, and horned lark, can be encouraged on grasslands by good livestock grazing management, by fencing to permit the free movement of antelope, and by developing watering facilities.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are the best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is poorly suited to use as homesites because of the hazard of flooding.

Capability subclass IIIe, nonirrigated, and IIe, irrigated.

33—Pits. This map unit consists of excavated areas that range from 5 to 60 acres in size. These areas are scattered throughout the county and are used as a source of material for gravelling roads or for embankments. Many are no longer used. Some of the broad, shallow excavations can be seeded with a grass mixture selected from recommended varieties of wheatgrasses, little bluestem, sideoats grama, and blue grama. The seedbed should be firm and as free as possible of competition from perennial plants. For best results, seeding should take place early in spring. The deeper excavations possibly could be used for sanitary landfills; however, onsite investigation and evaluation are needed to determine if ground-water pollution is a hazard.

34—Platner sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on smooth plains on high terraces in the northwestern part of the county. This soil formed in old alluvium. The areas range to 200 acres in size.

Included in mapping and making up about 20 percent of this map unit is Ascalon sandy loam. On about one-fourth of the acreage, the Platner soil has sand or gravelly sand in the substratum between depths of 24 and 40 inches. Also included are areas of eroded soils that have a surface layer of light yellowish brown, calcareous sandy loam.

Typically, the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is dark grayish brown clay loam about 10 inches thick. The substratum, to a depth of about 36 inches, is very pale brown, calcareous loam, and to a depth of 60 inches or more it is very pale brown, calcareous sandy loam.

Permeability is slow in the subsoil and moderately rapid below a depth of about 40 inches. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Surface runoff is medium. Water erosion is a slight to moderate hazard, and soil blowing is a severe hazard.

About 75 percent of the acreage of this map unit is cropland, irrigated and nonirrigated. Winter wheat grown in a crop-fallow system is the main nonirrigated crop. Corn is the main irrigated crop. This soil is fairly well suited to nonirrigated crops.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil fertility and tilth. Incorporating crop residue into the surface layer helps to control soil blowing, to improve soil tilth and water intake, and to reduce erosion. Minimizing tillage can help to maintain tilth and reduce erosion. Because this soil is low in nitrogen, fertilizer needs to be added for optimum yields on irrigated cropland. Grasses and legumes grown in rotation about one-fourth of the time help to maintain tilth and fertility and to improve water intake.

This soil is best suited to sprinkler irrigation. Water must be applied slowly enough to avoid runoff and to moisten the soil fairly deep.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are stubble mulch tillage and stripcropping. Where slopes are long enough to permit their use, terracing and contour farming are effective in reducing runoff. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue, which helps reduce soil blowing and trap snow. Nonirrigated cropland can be converted to grass by seeding with a mixture selected from the wheatgrasses, blue grama, and sideoats grama. The clean, firm stubble of millet or grain sorghum can be used as a seedbed. After seeding, grazing should be deferred until the end of the second growing season.

The potential native vegetation is dominantly blue grama, buffalograss, western wheatgrass, sedge, and green needlegrass. Continuous heavy grazing will cause western wheatgrass and green needlegrass to decrease, and blue grama and buffalograss will increase, forming a dense low-producing sod. Continued overuse will cause an invasion by red three-awn, snakeweed, cactus, fringed sagebrush, and other annuals. Deferred grazing can help to maintain the range potential. Mechanical practices such as pitting and contour furrowing are effective in reducing runoff on sodbound range.

Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed. The habitat for openland wildlife can be improved by planting trees and shrubs that are tolerant of droughty conditions. Undisturbed nesting cover is vital for pheasants. Establishing windbreaks can improve the habitat for openland wildlife.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites, but, because of the low bearing strength of the soil, foundation footings need to be wide enough to support the weight of buildings. This soil is well suited to use as septic tank filter fields if the leach lines are placed below the subsoil.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

35—Platner loam. This is a deep, well drained soil on smooth plains in the northwestern and southwestern parts of the county. It formed in loess-capped old alluvium. The areas are irregular in shape and range to 1,000 acres in size.

Included in mapping are Rago loam, which makes up about 5 percent of this map unit, and Ascalon fine sandy loam, which makes up about 15 percent. The Rago soil is in depressions or swales, and the Ascalon soil is on gentle, convex slopes. In places on high terraces near Red Willow and Coyote Creeks in the northern part of the county, the Platner soil has thin layers of gravel at a depth of 2 to 3 feet. In some areas, up to 2 acres in size, it is eroded and has a surface layer of pale brown, calcareous loam or sandy loam. Also included in mapping and scattered throughout this map unit are areas where the Platner soil is intermittently ponded. These areas generally are 5 acres or less in size and average 3 per square mile.

Typically, the surface layer is grayish brown loam about 6 inches thick. The subsoil is dark grayish brown clay loam about 13 inches thick. The substratum, to a depth of about 40 inches, is very pale brown loam and gravelly sandy loam. Below that, to a depth of 60 inches or more, it is pink gravelly sand (fig. 7).

Permeability is slow in the subsoil and moderately rapid below a depth of about 40 inches. The available water capacity is high. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

More than 95 percent of the acreage of this map unit is cultivated land. About 60 percent of this land is used for nonirrigated wheat. The rest of the cultivated land is mainly used for irrigated corn and sugar beets. This soil is well suited to nonirrigated crops because it has a high water-holding capacity. Wheat is grown in a crop-fallow system because the annual precipitation usually is insufficient for annual cropping.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth. Soil blowing can be controlled by leaving crop residue on the surface to protect the soil when crops are not grown. Soil tilth can be maintained by incorporating crop residue into the surface layer, by chiseling once every 3 or 4 years, and by minimizing tillage.

Figure 7.—Profile of Platner loam. The dark-colored surface layer and subsoil overlie the light-colored substratum.

This soil is suited to sprinkler irrigation or surface irrigation. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep. This is a fertile soil, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests can determine the rate at which fertilizer should be applied. Liberal applications of phosphorus and nitrogen fertilizers are needed where substratum material has been exposed by erosion or land leveling.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. The essential practices for controlling soil blowing and conserving moisture are stubble mulch tillage and stripcropping. Farming on the contour and terracing help to reduce surface runoff and conserve water. Soil tilth can be maintained by incorporating crop residue into the soil and by chiseling every 3 or 4 years to improve soil permeability. Emergency tillage that leaves clods of soil on the surface helps to control soil blowing in periods of combined wind and drought.

The potential native vegetation on this soil includes blue grama, buffalograss, western wheatgrass, sedge, and green needlegrass. Continuous heavy grazing on rangeland will cause western wheatgrass and green needlegrass to decrease; blue grama and buffalograss will increase, forming a dense, low-producing sod. Continued overuse will result in the invasion of red three-awn, broom snakeweed, cactus, fringed sagebrush, and other annuals. Deferred grazing can help to maintain the range potential. Mechanical practices such as pitting and contour furrowing are effective in reducing runoff on sodbound range.

This soil has good potential for the development of habitat for openland wildlife, including pheasant, cottontail, mourning dove, and songbirds, especially in areas under irrigation where a great variety of crops and cover types can be grown. The habitat for openland wildlife can be improved by planting trees and shrubs, including those suitable for use in windbreaks, and by establishing undisturbed nesting cover.

This soil generally is suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to use as homesites; however, the deficiency in the bearing strength of the soil and the shrink-swell potential are limitations. Foundation footings need to be sufficiently wide to provide a safety margin of support for the weight of buildings. Backfilling foundations with coarser textured material can reduce the effects of shrinking and swelling. Because of the slow permeability in the subsoil, septic tank filter fields need to be larger than normal. Placing leach lines below the subsoil can also correct the problem of slow permeability.

Capability subclass IIc, nonirrigated, and IIe, irrigated.

36—Platte fine sandy loam. This is a deep, poorly drained, nearly level soil on flood plains. It formed in calcareous sandy alluvium. The areas of this soil are elongated and range to 200 acres in size.

Included in mapping are small areas of Bankard soils. Bankard soils are on slightly higher terraces or near streambanks. They make up less than 10 percent of this map unit.

Typically, the surface layer is grayish brown fine sandy loam about 6 inches thick. The layer below that is pale brown fine sand about 7 inches thick. The underlying material is light brownish gray, stratified gravelly coarse sand to a depth of 60 inches or more.

Permeability is very rapid. The available water capacity is low. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard. Brief flooding occurs frequently. The depth to the water table is 24 inches or more.

This soil is used mainly as hayland and pasture. The water table enhances the production of grasses for forage.

Proper pasture and hayland management includes rotating grazing to allow proper plant regrowth, fertilizing, spraying to control weeds and brush, timely hay harvest, and harrowing to smooth the surface after haying or grazing.

The potential native vegetation is dominantly sand bluestem, indiangrass, switchgrass, prairie cordgrass, little bluestem, sedge, and rushes. If the range deteriorates, the dominant grasses will decrease in number, and forbs and wood shrubs will increase. Deteriorated range can be improved by interseeding with a mixture of indiangrass, switchgrass, and sand bluestem.

In areas where this soil is wet, shallow-water areas can be developed by excavation or pothole blasting to improve the habitat for waterfowl and shorebirds. Because of the availability of moisture, this soil can provide excellent nesting cover for waterfowl if livestock grazing is carefully managed. The tree and shrub species that are suitable for use in farmstead windbreaks can also be used to improve wildlife habitat.

This soil generally is well suited to windbreaks and environmental plantings. Poor drainage and the abundant and persistent vegetation are the principal limitations to establishing trees and shrubs. Continued cultivation for weed control and careful plant selection are needed to insure the survival of plantings. The trees that are best adapted and that have a good chance of survival are eastern cottonwood, golden willow, and Rocky Mountain juniper; the shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

This soil is poorly suited to use as homesites because of the wetness, flooding, and pollution hazards.

Capability subclass Vw, nonirrigated.

37—Rago loam. This is a deep, well drained, nearly level soil on the slightly concave parts of smooth plains. This soil formed in loess. The areas are irregular in shape and range to 1,000 acres in size. They are mainly in the northern part of the county. Slopes generally are less than 2 percent.

Included in the mapped areas is Platner loam, which makes up about 10 percent of this map unit. Areas where the soil is intermittently ponded, up to 5 acres or more in size, are scattered throughout the map unit, averaging about 10 per square mile.

Typically, the surface layer is grayish brown loam about 8 inches thick. The upper part of the subsoil is grayish brown and dark grayish brown heavy clay loam about 12 inches thick, and the lower part is very dark grayish brown heavy silty clay loam about 9 inches thick. The substratum, to a depth of about 37 inches, is light gray silt loam. Below that, to a depth of 60 inches or more, it is very pale brown loam and fine sandy loam.

Permeability is slow in the subsoil and moderate in the substratum. The available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard. Soil fertility is high.

At least 95 percent of the acreage of this unit is cropped. Winter wheat is the main nonirrigated crop. It is grown in a crop-fallow system because the climate is too dry for annual cropping. Corn and sugar beets are the main irrigated crops. About 5 percent of the acreage of this soil is used for grazing.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth. Soil blowing can be controlled by leaving crop residue on the surface to protect the soil when crops are not grown. Soil tilth can be maintained by incorporating crop residue into the surface layer, by subsoiling once every 3 or 4 years, and by minimizing tillage.

This soil is suited to sprinkler irrigation or surface irrigation. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep. This is a fertile soil, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests can determine the rate at which fertilizer should be applied. Liberal applications of phosphorus and nitrogen fertilizers are needed where substratum material has been exposed by erosion or land leveling.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. The essential practices for controlling soil blowing and conserving moisture are stubble mulch tillage and stripcropping. Farming on the contour and terracing help to reduce surface runoff and conserve water. Soil tilth can be maintained by incorporating crop residue into the soil and by subsoiling every 3 or 4 years to improve soil permeability. Emergency tillage that leaves clods of soil on the surface helps control soil blowing in periods of combined wind and drought.

The potential native vegetation on this soil includes blue grama, buffalograss, western wheatgrass, and green needlegrass. Continuous heavy grazing causes western wheatgrass and green needlegrass to decrease in the plant community and causes blue grama and buffalograss to increase, forming a dense, low-producing sod. Range pitting will help to improve sodbound range. Deferred grazing helps to maintain the range potential.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. Farmstead windbreaks can be established to improve the habitat for openland wildlife.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is not well suited to use as homesites because of the shrink-swell potential and slow runoff. Houses should be located on a constructed pad to avoid damage by the ponding caused by slow runoff. Backfilling foundations and especially basement walls with coarser textured material can reduce the effects of shrinking and swelling. Because of slow permeability in the subsoil, septic tank fields need to be larger than normal.

Capability subclass IIc, nonirrigated, and IIe, irrigated.

38—Rago clay loam, occasional overflow. This is a deep, well drained, nearly level soil on slightly concave flood plains that are subject to occasional overflow. This soil formed in loess. The areas are irregular in shape and range to 800 acres in size. They are mainly in the northern part of the county. Slopes generally are less than 2 percent.

Included in mapping and making up about 10 percent of this map unit are areas of Albinas loam. Also included, along the edge of sandhills, is a soil that is similar to this Rago soil in enclosed basins that are as much as 60 acres in size. These basins are at the end of intermittent drainageways and are ponded for several weeks at a time.

Typically, the surface layer is grayish brown clay loam about 10 inches thick. The subsoil is dark grayish brown heavy silty clay loam about 22 inches thick. The substratum, to a depth of about 50 inches, is dark grayish brown, calcareous clay loam. Below that, to a depth of 60 inches or more, it is light gray, calcareous loam.

Permeability is slow. The available water capacity is high. Surface runoff is slow. Water erosion and soil blowing are slight hazards. The soil is relatively high in fertility but is somewhat difficult to till. The areas of this soil are dissected by a drainage channel that overflows briefly once in ten years, on the average.

At least 95 percent of the acreage of this soil is cultivated land. On nonirrigated land, winter wheat is grown in a crop-fallow system. Corn is the main irrigated crop.

The main management problem of irrigated cropland is maintaining soil tilth. Tilth can be maintained by incorporating crop residue into the surface layer, by subsoiling once every 3 or 4 years, and by minimizing tillage.

This soil is suited to sprinkler irrigation or surface irrigation. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep. This is a fertile soil, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests can determine the rate at which fertilizer should be applied. Liberal applications of phosphorus and nitrogen fertilizers are needed where substratum material has been exposed by erosion or land leveling. The infrequent overflow has the potential for damaging crops. In some fields, low dikes can be constructed to prevent damage to crops by overflow.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. Soil blowing can be controlled and moisture conserved by stubble mulch tillage and stripcropping. Soil tilth can be maintained by incorporating crop residue into the soil and by subsoiling every 3 or 4 years to improve soil permeability. Emergency tillage that leaves clods of soil on the surface helps to control blowing in periods of combined wind and drought.

The potential native vegetation on this soil includes blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges. Continuous heavy grazing causes western wheatgrass and green needlegrass to decrease in the plant community, and blue grama and buffalograss will increase, forming a dense, low-producing sod. Range pitting will help to improve sodbound range. Deferred grazing helps to maintain the range potential.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned, especially in areas of intensive agriculture. The trees and shrubs that are suitable for use in farmstead windbreaks can be planted to help improve the habitat for openland wildlife.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year before

planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is poorly suited to use as homesites because of the hazard of flooding.

Capability subclass IIw, nonirrigated and irrigated.

39—Razor-Midway complex, 3 to 9 percent slopes. This complex consists of gently sloping to moderately sloping soils on dissected slopes along the valleys of the Republican and Arikaree Rivers in the east-central part of the county. These soils formed in material that weathered from calcareous platy shale. The areas of this complex range to 100 acres in size.

This complex is about 60 percent Razor soil and 20 percent Midway soil. The Razor soil is underlain by shale at a depth of about 28 inches, and the Midway soil is underlain by shale at a depth of less than 20 inches.

Included in mapping and making up about 20 percent of this complex is a soil that is similar to the Razor soil except that it is more than 40 inches deep to shale. This soil generally has slopes of less than 3 percent.

The Razor soil is moderately deep, and well drained. Typically, the surface layer is grayish brown clay loam about 4 inches thick. The subsoil is brown clay loam about 9 inches thick. The substratum is light brownish gray clay about 15 inches thick. Clay shale is at a depth of about 28 inches.

Permeability is slow. The effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

The Midway soil is shallow and well drained. Typically, the surface layer is grayish brown, calcareous silty clay loam about 4 inches thick. The layer below that is light brownish gray, limy calcareous clay loam about 9 inches thick. Light brownish gray clay shale is at a depth of about 13 inches.

Permeability is slow. The effective rooting depth is 6 to 20 inches. The available water capacity is very low. Surface runoff is medium. Water erosion and soil blowing are moderate hazards.

These soils are used for grazing and as irrigated and nonirrigated cropland. These soils are most productive in areas where irrigation water is available. These soils are difficult to manage because of the clayey texture of the surface layer, which results in poor tilth and slow water intake.

On irrigated cropland, growing cover crops and green manure crops, leaving crop residue on the soil, and rotating grasses and legumes in the cropping system can help to improve soil tilth and increase the rate of water intake. Chiseling or subsoiling and minimum tillage can improve and maintain the aeration in the root zone. Land leveling and management of irrigation water are needed for efficient use of water. Water is normally applied in furrows or corrugations. Fertilizer applied at the rate determined by soil tests can increase crop yields.

In most areas, these soils have slopes of more than 3 percent and thus, they are only marginally suited to nonirrigated crops. On nonirrigated land, a system of fallow alternated with small grains or sorghum is used. Incorporating crop residue into the surface layer can help to improve tilth and water intake. Contour farming and terracing can reduce runoff. Chiseling or subsoiling and minimum tillage can improve the aeration in the root zone.

The potential native vegetation on rangeland includes blue grama, western wheatgrass, and winterfat. Continuous heavy grazing causes western wheatgrass, sideoats grama, and winterfat to decrease and causes blue grama, buffalograss, and forbs to increase.

Mechanical practices such as range pitting and contour furrowing and proper range use including deferred grazing can improve and maintain native range.

Nonirrigated cropland can be converted to grass by planting western wheatgrass, crested wheatgrass, and blue grama into a prepared seedbed or, when moisture conditions are favorable, into the clean, firm stubble of sorghum or millet. In some areas, timely mowing at a height of 10 to 12 inches or applying herbicides is necessary to control weeds.

Rangeland wildlife, including antelope, cottontail, coyote, and scaled quail, are best adapted to the habitat on this clayey soil. Forage production typically is low, and proper livestock grazing management is necessary if wildlife and livestock are to share the range. Livestock watering facilities, which are used by some wildlife, need to be established to improve the habitat. On irrigated land, openland wildlife can be encouraged by providing food and cover.

This soil is very poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine if plantings are feasible.

These soils are poorly suited to use as sites for houses and septic tank disposal systems because of the high shrink-swell potential and slow permeability. Foundations or basement walls need to be specially designed to overcome the high shrink-swell potential. Septic tank filter fields can be installed on a constructed pad of more permeable material. These soils can be used for sewage lagoons, but the lagoons need to be sealed to prevent seepage through shale crevices.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

40—Richfield silt loam. This is a deep, well drained, level and nearly level soil on smooth plains in the northwestern part of the county. It formed in loess. The mapped areas range to 1,000 acres in size.

Included in the mapped areas is Rago loam, which makes up as much as 10 percent of this map unit. In

some areas, as much as 2 acres in size, the soil is eroded, and the pale brown, loamy substratum material is exposed.

Typically, the surface layer is brown silt loam about 3 inches thick. The upper part of the subsoil is brown clay loam about 7 inches thick, and the lower part is dark grayish brown and pale brown silty clay loam about 18 inches thick. The substratum, to a depth of 60 inches or more, is light gray silt loam.

Permeability is moderately slow. The available water capacity is high. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

More than 95 percent of the acreage of this soil is cultivated land. About 60 percent of this land is used for nonirrigated winter wheat, and the rest is used for irrigated corn and sugar beets. This soil is well suited to crops because it has a high water-holding capacity.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil tilth. Soil blowing can be controlled by leaving crop residue on the surface to protect the soil when crops are not grown. Soil tilth can be maintained by incorporating crop residue into the surface layer, by chiseling once every 3 or 4 years, and by minimizing tillage.

This soil is suited to sprinkler irrigation or surface irrigation. Because of slow intake, the water must be applied slowly, and enough water must be applied to moisten the soil fairly deep. This is a fertile soil, but the high yields of irrigated crops can create a nutrient deficiency. Soil tests can determine the rate at which fertilizer should be applied. Liberal applications of phosphorus and nitrogen fertilizers are needed where substratum material has been exposed by erosion or land leveling.

The main concerns in managing nonirrigated cropland are controlling soil blowing, maintaining soil tilth, and conserving soil moisture. The essential practices for controlling soil blowing and conserving moisture are stubble mulch tillage and stripcropping. Farming on the contour and terracing help to reduce surface runoff and conserve water. Soil tilth can be maintained by incorporating crop residue into the soil and by chiseling every 3 or 4 years to improve soil permeability. Emergency tillage that leaves clods of soil on the surface helps to control soil blowing in periods of combined wind and drought.

The potential native vegetation on this soil includes blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges. Continuous heavy grazing causes western wheatgrass and green needlegrass to decrease and causes blue grama and buffalograss to increase, forming a dense, low-producing sod. Continuous overuse will result in the invasion of red three-awn, broom snakeweed, cactus, fringed sagebrush, and other annuals. Range pitting can help to improve sodbound range. Proper grazing use, including deferred grazing, can help to maintain the range potential.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants and should be planned for, especially in areas of intensive agriculture. Farmstead windbreaks can provide food and excellent cover for openland wildlife.

This soil is generally well suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to use as homesites, but the shrink-swell potential and low soil strength are limitations. Foundation footings need to be wide enough to provide a safety margin of support for the weight of buildings. Backfilling foundations with coarser textured material can reduce the effects of shrinking and swelling. The permeability in the subsoil is a limitation for septic tank filter fields. Placing leach lines below the subsoil can help alleviate this problem.

Capability subclass IIc, nonirrigated, and IIe, irrigated.

41—Stoneham loam. This is a deep, well drained, nearly level soil on smooth plains on high terraces in the southeastern part of the county. This soil formed in wind-reworked old alluvium. The areas range to 400 acres in size. Slopes are 0 to 3 percent.

Included in mapping are Ascalon fine sandy loam and Kim loam, which each make up as much as 10 percent of this map unit. The Ascalon soil is in elongated areas on slightly concave slopes. The Kim soil is in elongated areas on convex slopes.

Typically, the surface layer is grayish brown loam about 3 inches thick. The upper part of the subsoil is brown clay loam about 4 inches thick, and the lower part is light brown sandy clay loam 7 inches thick. The substratum, to a depth of 60 inches or more, is pink, calcareous sandy clay loam.

Permeability is moderate. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

About 30 percent of the acreage of this unit is irrigated and nonirrigated cropland, and 70 percent is native rangeland. Wheat is grown in a crop-fallow system because precipitation is insufficient for annual cropping. Alfalfa is the main irrigated crop.

The main concerns in managing irrigated cropland are controlling soil blowing and maintaining soil fertility and tilth. Soil blowing can be controlled by leaving crop

residue on the surface or by incorporating it into the surface layer. Incorporating residue into the surface layer also improves soil tilth and water intake and reduces erosion. Minimizing tillage helps to maintain tilth and reduce erosion. Fertilizer is needed because this soil is relatively low in nitrogen. Phosphorus is needed if alfalfa is grown. Grasses and legumes grown in rotation about one-fourth of the time help to maintain good tilth and fertility and to improve water intake.

This soil is best suited to sprinkler irrigation. Surface irrigation in furrows or corrugations can also be used. Water must be applied slowly enough to avoid runoff, and enough water must be applied to moisten the soil fairly deep.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential soil conservation practices are stubble mulch tillage and stripcropping. Where soil slopes are long enough to permit their use, terracing and contour farming are effective in reducing runoff.

The potential native vegetation on this soil includes blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges. Continuous heavy grazing causes western wheatgrass and green needlegrass to decrease; blue grama and buffalograss will increase, forming a dense sod. Continued overuse will result in the invasion of red three-awn, broom snakeweed, cactus, fringed sagebrush, and other undesirable plants. Proper grazing use, including deferred grazing, can help to maintain the range potential. Mechanical practices, such as contour furrowing and range pitting, can help to improve sodbound range and to reduce runoff.

Cultivated fields can be converted to grass by planting a mixture selected from the wheatgrasses, blue grama, and sideoats grama into the clean, firm stubble of millet or grain sorghum.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is well suited to windbreaks and environmental plantings. Summer fallow a year before planting, supplemental water during planting and in the early stages of growth, and continued cultivation for weed control are needed to insure the establishment and survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is well suited to use as homesites and septic tank filter fields.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

42—Terry loamy sand. This is a moderately deep, well drained soil on smooth plains in the south-central part of the county. It formed in wind-sorted calcareous material that derived from sandstone bedrock. Slopes range from 1 to 6 percent but are mainly about 3 percent. Mapped areas range to 200 acres in size.

Included in the mapped areas are Canyon loam and Dioxice fine sandy loam, which make up about 10 percent of this map unit, and Haxtun loamy sand, which makes up 5 percent. The Haxtun soil is in swales, and the Canyon and Dioxice soils are on ridges and knolls.

Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The subsoil is grayish brown, brown, and light brownish gray loam about 19 inches thick. Fractured sandstone rock is at a depth of 26 inches.

Permeability is moderately rapid. The available water capacity is low. The effective rooting depth is 20 to 34 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

More than 95 percent of the acreage of this map unit is rangeland. Some small areas are part of irrigated cropland or have been seeded to grass. The main concern in managing irrigated cropland is controlling soil blowing. Light frequent applications of water make the most efficient use of water.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. Continuous heavy grazing causes needleandthread, switchgrass, and prairie sandreed to decrease in the plant community and causes blue grama, sand sagebrush, and sand dropseed to increase. Extreme heavy use will cause annual weeds and grasses to invade the plant community.

Because of the limited water-holding capacity of the soil, proper range use is continually needed to maintain the range potential. Proper use includes deferred grazing and, in places, seeding and management of sand sagebrush.

The range condition can be improved by interseeding at the rate recommended for pure live seed of a mixture selected from sand bluestem, little bluestem, switchgrass, prairie sandreed, indiangrass, and Indian ricegrass. After interseeding, grazing should be deferred until the fall of the second growing season.

Wildlife habitat, especially for rangeland wildlife, is an important secondary use for this soil. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil generally is poorly suited to windbreaks and environmental plantings because of the limited rooting depth and the low water-holding capacity.

This soil is suitable for use as sites for houses that do not have a basement. The underlying rock hinders basement construction but is rippable using construction

machinery. The underlying rock makes the soil very poorly suited to use as septic tank filter fields. If leach fields can not be placed in nearby suitable soils, special effluent designs will be needed.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

43—Valent sand, 1 to 9 percent slopes. This is a deep, excessively drained soil on sandhills in the northeastern and southwestern parts of the county. It formed in eolian sand. The areas range to 1,500 acres in size. Slopes are mainly 3 to 9 percent.

Included in the mapped areas are Haxtun loamy sand, which makes up 10 percent of the map unit, and Dailey loamy sand, which makes up 20 percent. The Haxtun soil generally is in depressions between sandhills, and the areas are 1 to 7 acres in size. The Dailey soil is on the concave part of slopes, and the areas are 5 to 40 acres in size. Also included are many blowouts, 5 acres or less in size. On the average, there are 4 blowouts per square mile in this unit.

Typically, the surface layer is grayish brown sand about 4 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown sand. In places along the Arikaree River, the soil material above a depth of 40 inches is calcareous.

Permeability is very rapid. The available water capacity is low. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

More than 80 percent of the acreage of this map unit is native rangeland. The rest is irrigated cropland. Corn is the main crop. Other crops include grain sorghum, alfalfa, and pasture grasses. This soil is only marginally suited to cultivation because it is droughty and soil blowing is a severe hazard.

The main concerns in managing irrigated cropland are controlling water erosion and soil blowing and maintaining soil fertility and the organic matter content. Soil blowing can be minimized by leaving crop residue on the surface as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that helps prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation up to half of the time help to maintain the organic matter content. Decomposition of organic matter in the soil has a stabilizing effect that helps this soil resist soil blowing.

This soil is suited only to sprinkler irrigation. Frequent light applications of water make the most efficient use of water and reduce erosion. On short steep slopes, gullies can form in the wheel path of sprinklers. This problem can be prevented by avoiding overirrigation and by maintaining irrigation equipment in good condition. Fertilizers that add large quantities of nitrogen and phosphorus to the soil are needed for profitable crop yields. Soil tests and anticipated yields should be used to estimate application rates.

The potential native vegetation on this soil is dominantly sand bluestem, needleandthread, prairie sandreed, and blue grama. If the range deteriorates, prairie sandreed, switchgrass, and sand bluestem decrease in number, and blue grama, sand sagebrush, and yucca increase. Soil blowing is a hazard on overgrazed range. The main conservation practices on rangeland are sand sagebrush management, fencing, livestock water development, and deferred grazing.

Interseeding can help improve range in poor condition. A mixture of pure live seed selected from sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass should be seeded at the recommended rate. After seeding, grazing should be deferred until the end of the second growing season.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed. The trees and shrubs recommended for use in farmstead windbreaks can also improve the habitat for openland wildlife.

This soil is fairly well suited to windbreaks and environmental plantings. Soil blowing and the limited available water capacity are the principal limitations to establishing trees and shrubs. Trees need to be planted in shallow furrows and vegetation maintained between the rows. Supplemental irrigation is needed to insure the survival of plantings. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, and Siberian elm; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to use as homesites and septic tank filter fields. Blowing sand can be a problem on construction sites.

Capability subclass VIe, nonirrigated, and IVe, irrigated.

44—Valent sand, 9 to 15 percent slopes. This is a deep, excessively drained soil on sandhills, mainly in the northeastern part of the county. It formed in eolian sand. The areas range to 2,000 acres in size.

Included in mapping and making up as much as 15 percent of this map unit is Dailey loamy sand. This soil is in depressions between sandhills, and the areas are 1 to 5 acres in size. Also included are many blowouts, 5 acres or less in size. On the average, there are 8 to 12 blowouts per square mile in this map unit.

Typically, the surface layer is grayish brown sand about 4 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown sand.

Permeability is very rapid. The available water capacity is low. The effective rooting depth is more than 60 inches. Surface runoff is slow. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Nearly all of this map unit is native rangeland. Proper range management is necessary to control erosion. This soil is not suited to irrigation because the steep slopes make erosion control unfeasible.

The potential native vegetation on this soil is dominantly sand bluestem and prairie sandreed. If the range deteriorates, prairie sandreed and sand bluestem will decrease in number, and sand sagebrush, blue grama, hairy grama, sandhill muhly, and wormwood sagebrush will increase. Grazing must be light to moderate because of the hazard of soil blowing.

The main conservation practices on rangeland are sand sagebrush management, fencing, livestock water development, and deferred grazing.

Wildlife habitat, especially for rangeland wildlife, is an important secondary use for this soil. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil is poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine if plantings are feasible.

This soil is moderately suited to use as homesites and septic tank filter fields. Slope is the main limitation to these uses. Blowing sand can be a problem on homesites.

Capability subclass VIIe, nonirrigated, and VIe, irrigated.

45—Valent sand, 15 to 45 percent slopes. This is a deep, excessively drained, hilly soil on sandhills in the northeastern part of the county. It formed in eolian sand. The mapped areas range from 40 to 1,800 acres in size.

Included in mapping are many blowouts, 5 acres or less in size. In this map unit, there are between 30 and 50 blowouts per square mile.

Typically, the surface layer is grayish brown sand about 4 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown sand.

Permeability is very rapid. The available water capacity is low. The effective rooting depth is 60 inches or more. Surface runoff is slow. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Nearly all of this map unit is native rangeland.

The potential native vegetation on this soil is dominantly sand bluestem and prairie sandreed. Deterioration of the range causes these two grasses to decrease in number and causes sand sagebrush, hairy grama, blue grama, and wormwood sagebrush to increase. Grazing must be light to moderate because of the hazard of soil blowing.

The main conservation practices on rangeland are sand sagebrush management, fencing, livestock water development, and deferred grazing.

Wildlife habitat, especially for rangeland wildlife, is an important secondary use for this soil. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

This soil is poorly suited to use as homesites because of the steep slopes and loose sand.

Capability subclass VIIe, nonirrigated.

46—Valent-Blownout land complex, 1 to 25 percent slopes. This complex consists of areas of Valent sand that have many blowouts. The areas generally are rounded or oval and range to 40 acres in size. They are on sandhills. This complex is about 40 percent Valent sand, 40 percent Blownout land, and 20 percent areas of bare dune sand.

The Valent soil is deep and excessively drained. It formed in eolian sand. Typically, the surface layer is grayish brown sand about 4 inches thick. The underlying material, to a depth of 60 inches or more, is pale brown sand.

Permeability is very rapid. The available water capacity is low. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Blownout land is areas of shallow depressions that have flat or irregular floors formed by more resistant layers of underlying material. Hummocks or small sand dunes are also included in Blownout land. The floors are barren or have a sparse cover of red three-awn and other annuals. The hummocks and dunes have a sparse cover of blowout grass, prairie sandreed, hairy grama, sand dropseed, and sand bluestem.

This complex can be reclaimed by first fencing the areas to exclude livestock. After fencing, a mixture of adapted grasses and legumes should be interseeded early in spring or late in fall, when moisture conditions are most favorable for germination. Adapted species include big bluestem, sand bluestem, sideoats grama, prairie sandreed, sand lovegrass, alfalfa, yellow sweetclover, switchgrass, indiangrass, and sand dropseed. In some areas, straw mulching is necessary to stabilize blowing sand until the grasses or weeds are established. After grasses begin to grow, light applications of nitrogen fertilizer, along with favorable moisture, can speed growth. Grazing by livestock should be postponed for at least three years.

Capability subclass VIIe, nonirrigated.

47—Vona loamy sand. This is a deep, well drained soil on smooth plains in the southern part of the county. It formed in eolian sand. The areas of this soil are irregular in shape and range to 400 acres in size. Slopes are less than 3 percent.

Included in the mapped areas are Haxtun loamy sand, which makes up about 15 percent of the map unit, and Valent sand, which makes up less than 5 percent. The Haxtun soil is in swales or shallow depressions, and the Valent soil is on gentle slopes along the perimeter of the mapped areas.

Typically, the surface layer is light brownish gray loamy sand about 18 inches thick. The subsoil is brown fine sandy loam about 16 inches thick. The substratum, to a depth of 44 inches, is white very fine sandy loam. Below

that, to a depth of 60 inches or more, it is very pale brown loamy fine sand.

Permeability is moderately rapid. The available water capacity is moderate. The effective rooting depth is more than 60 inches. Runoff is slow. Water erosion is a slight hazard, and soil blowing is a severe hazard.

About two-thirds of the acreage of this map unit is used for grazing. The rest is used for nonirrigated feed crops or for sprinkler-irrigated corn.

The main concerns in managing irrigated cropland are controlling soil blowing, which can result in large losses of the organic matter in the soil, and maintaining soil fertility. Soil blowing can be controlled by leaving crop residue lying on the surface or as standing stubble when crops are not grown. Crops can be seeded directly into the crop residue, which serves as a protective mulch that helps to prevent damage to young crops by soil blowing. Grasses and legumes grown in rotation about one-fourth of the time help to restore organic matter lost by soil blowing. Decomposition of organic matter in soil has a stabilizing effect that helps the soil resist soil blowing.

This soil is best suited to sprinkler irrigation. Frequent light applications of water, particularly early in the growing season, make the most efficient use of water. Fertilizers that add nitrogen and phosphorus to the soil, applied at rates determined by soil tests, normally increase the yield of irrigated crops. Liberal applications of nitrogen and phosphorus fertilizers are needed where substratum material has been exposed by land leveling or erosion.

The main concerns in managing nonirrigated cropland are controlling soil blowing and conserving soil moisture. The essential conservation practices are leaving crop residue on the soil, stubble mulch tillage, and stripcropping. Light applications of nitrogen fertilizer normally will result in larger amounts of crop residue which helps to reduce soil blowing and trap snow. The soil needs a protective cover at all times. Row crops grown annually or alternated with small grains can provide enough crop residue to protect the soil.

The potential native vegetation is dominantly sand bluestem, needleandthread, prairie sandreed, switchgrass, and blue grama. Continuous heavy grazing will cause sand bluestem, needleandthread, switchgrass, and prairie sandreed to decrease in the plant community, and blue grama, sand sagebrush, and sand dropseed will increase. Extreme heavy use causes annual weeds and grasses to invade. The essential conservation practices on rangeland are deferred grazing and management of sand sagebrush.

Overgrazed rangeland can be improved by interseeding with a mixture selected from sand bluestem, little bluestem, sideoats grama, prairie sandreed, blue grama, Indian ricegrass, switchgrass, and indiangrass. Nonirrigated cropland can be converted to grass by seeding wheatgrasses, sand bluestem, switchgrass, and indiangrass directly into the clean, firm stubble of sorghum or millet.

Wildlife habitat, especially for openland and rangeland wildlife, is an important secondary use for this soil. Habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed on cropland by establishing nesting and escape cover. Undisturbed nesting cover is vital for pheasants. Rangeland wildlife, for example, the pronghorn antelope, can be encouraged by developing livestock watering facilities, by properly grazing livestock, and by range seeding, where needed.

The trees and shrubs recommended for use in farmstead windbreaks can be planted to improve the habitat for openland wildlife.

This soil generally is suited to windbreaks and environmental plantings. Soil blowing is the principal limitation to establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree row and by leaving a strip of vegetation between the rows. Supplemental irrigation is necessary at the time of planting and during dry periods. The trees that are best adapted and that have a good chance of survival are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry; the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This soil is well suited to use as homesites and septic tank filter fields. Soil blowing is a problem on construction sites.

Capability subclass IVe, nonirrigated, and IIIe, irrigated.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to figures obtained from the county assessor's office, about 589,700 acres, or about 40 percent of Yuma County, was used for crops and pasture in 1976. Of this total, 387,400 acres is nonirrigated cropland, 185,200 acres is irrigated cropland, and 17,100 acres is meadows and pastures. Most of the remaining acreage in the county is rangeland; a small percentage is town sites, rural commercial land, or lakes and streams.

Ascalon, Haxtun, Keith, Kuma, Manter, Platner, Rago, and Richfield soils are the main soils used for crops in Yuma County. These soils have good potential for increased food production. Food production can be increased by extending the latest crop production technology to all the cropland in the county. For example, an alternative to summer fallow can be found for some or all of the approximately 133,000 acres that lie idle each year.

Soil blowing is the major problem on all the cropland in the county. In general, the hazard of soil blowing increases in proportion to the content of sand in the soil.

On cropland soils that have more than 3 percent slopes, water erosion can be a problem. Sheet, rill, and gully erosion are three forms of water erosion. They are distinguished one from another by the relative depth and stability of the channels cut by runoff.

The loss or alteration of soil by erosion is damaging to the natural environment in two ways. First, productivity is reduced as the surface layer is eroded and subsoil material is incorporated into the plow layer. Erosion of the surface layer is especially damaging to soils that have a clayey subsoil, for example, Platner, Richfield, and Rago soils, and to soils that have a layer below the subsoil that restricts the depth of the root zone, for example, Iliff soils. Second, soil erosion on farmland results in sedimentation in streams. Controlling erosion reduces the pollution of streams by sediment and improves the quality of water for municipal use, for recreation use, and for fish and wildlife.

Erosion and soil blowing on cropland can be controlled by using a conservation cropping system. A conservation cropping system includes the use of grasses and legumes in rotation as well as cropping sequences in which the soil can be conserved and productivity

maintained without the use of such crops. It also maintains a vegetative cover on the soil that helps to control erosion so that the productivity of the soils is not reduced and streams are not endangered by sedimentation.

Conservation cropping systems vary according to the needs of the soil and the intensity of use. In Yuma County, irrigated cropland and nonirrigated cropland differ significantly in intensity of use and management needs.

The nonirrigated cropland in Yuma County is mainly in areas of well drained, nearly level, hardland soils that have a loam, silt loam, or loam surface layer. These soils have a high available water capacity. They are about 2 percent organic matter and have a stable structure that resists soil blowing. These hardland soils have long gentle slopes and thus are well suited to contour farming and terracing, which help to reduce runoff. They are well suited to hard red winter wheat; however, the semiarid climate precludes the annual cropping of wheat. On these soils, wheat is alternated with summer fallow to conserve moisture for the crop that follows.

Sandy loam soils also are used as nonirrigated cropland. Because the structure of these soils is not so stable as that of the hardland soils, sandy loam soils are subject to soil blowing and are readily depleted of organic matter. They have slopes that generally are too short and irregular for contour farming or terracing. Because of the hazard of soil blowing, summer fallow is more hazardous to sandy loam soils than to hardland soils.

The conservation cropping system used on nonirrigated cropland should be designed to control soil blowing, reduce runoff, and conserve soil moisture. It normally consists of winter wheat alternated with fallow or a row crop. On soils that are badly eroded, the cropping system can include converting the soils to a permanent cover or grass.

In a conservation cropping system on nonirrigated cropland, repeated tillage is necessary to control weeds and volunteer small grain and to loosen the soil to improve water penetration. Delaying tillage as long as possible and minimizing the number of operations can preserve the crop residue and soil tilth and reduce the evaporation of soil moisture. Subsurface tillage equipment such as sweeps, blades, and rod weeders can be used to maintain wheat stubble on the surface. This equipment is less apt to cause tillage pans in the soil than is disc-type equipment. The soil should not be tilled when it is very moist. After harvest, chemical spraying can be used instead of tillage to control weeds and volunteer small grain. This also conserves soil moisture and preserves stubble, which helps to trap snow.

On sandy loam soils, a cropping system of winter wheat alternated with corn or grain sorghum is recommended rather than a crop-fallow system. This system minimizes loss of soil and organic matter through soil blowing; however, it can reduce yields in some years. Light applications of nitrogen fertilizer in fall or early in spring can increase the amount of crop residue produced on sandy loam soils and usually increases crop yields.

On some soils, chiseling is necessary every few years to shatter restrictive layers that form beneath the plow layer. Richfield and Platner soils are especially susceptible to the formation of tillage pans. Chiseling should take place when the soil is relatively dry. Chiseling can be used for tillage pans within a depth of 16 inches. For tillage pans deeper than 16 inches, such as those that tend to form in Rago soils, subsoiling is necessary.

Stripcropping is effective in controlling soil blowing and water erosion on nonirrigated cropland. Field stripcropping consists of growing crops in strips across the general slope of the land. The crops are arranged so that a strip of grass or other close-growing crop is alternated with a clean-tilled crop or fallow. Contour stripcropping is the arrangement of such strips along the contour of the land. Wind stripcropping consists of wind-resistant crops alternated with fallow or row crops in strips arranged at right angles to the prevailing wind.

Emergency tillage is sometimes necessary to control soil blowing in periods of extreme drought and wind, which occur most often in early spring. Emergency tillage consists of roughening the soil surface with tillage implements. Duckfoot or chisel-type implements are used on hardland soils such as Platner, Richfield, and Kuma soils. Lister-type implements are used on sandy soils such as Manter soils. To be effective, chiseling must penetrate the soil to a depth of four or more inches, and listing must leave a ridge at least six inches above the furrow bottom.

The soils that are the best suited to use as irrigated cropland generally are those that are the best suited to use as nonirrigated cropland. However, because the climatic limitation of dryness can now be overcome through irrigation, all soils ranging from sands to clay loams can be used as irrigated cropland. Sprinkler systems are being used on the sandy Valent soils. However, the rolling and hilly Valent soils generally are unsuited to irrigation because of their sandy texture and steep slopes. The gently rolling Valent soils are marginally suited to irrigation; they require frequent light applications of water to maintain soil moisture and to reduce losses of water and nitrogen through leaching. Land leveling in areas of Valent soils generally is not beneficial because it destroys the surface layer, which results in the loss of organic matter and increases the hazard of soil blowing.

Under irrigation management, crop residue is normally produced in abundance and can be used to protect the soil. Livestock should not be grazed too heavily in fall because the protective cover of residue will be lost and the trampling will compact the soil.

Minimum tillage generally is necessary on irrigated hardland soils to maintain soil tilth. Crop residue, grasses

and legumes grown in rotation, and barnyard manure can be worked into the soil to increase the organic matter content and to help maintain tilth. Soils should not be tilled when they are very moist. On sandy soils minimum tillage preserves the protective cover. One form of minimum tillage commonly used on sandy soils consists of seeding directly into the residue of the previous crop and at the same time applying fertilizer and preemergence chemical weed inhibitor to the soil. The crop residue serves as a protective mulch for emerging seedlings.

The irrigation methods used in Yuma County include sprinkler irrigation and surface irrigation by furrows, corrugations, or controlled flooding.

Sprinkler irrigation is the most widely used irrigation system in Yuma County. It can be used for all crops grown in the county and on all soils normally cropped. Sprinkler irrigation is particularly well suited to sandy soils that require frequent light applications of water and are in areas where land leveling is difficult because of the hazard of soil blowing and the uneven surface.

Under sprinkler irrigation, the rate at which water is applied and the amount of water applied can be controlled, and fertilizer can be metered into the water so that little is lost through runoff. The disadvantages of sprinkler irrigation are the high initial cost of installation, high evaporation losses on hot days, uneven distribution on very windy days, and the high power consumption needed to maintain nozzle pressure.

The nearly level Kuma and Rago soils, which require little land leveling, are well suited to surface irrigation. On these soils, water can be applied in furrows, in corrugations, or by flooding within borders, depending on the crop grown. With some land leveling, Platner and Richfield soils are well suited to irrigation by furrows or corrugations.

On soils that have long gentle slopes, field ditches on the contour can be used to control flood irrigation or to release water into corrugations. They can be used to irrigate areas of the gently undulating Colby and Ascalon soils.

Under surface irrigation, land leveling costs can be high, and water can not be controlled so well as under sprinkler irrigation. Gated pipe on the contour can be used instead of field ditches to provide better control of irrigation water. In some systems, tailwater recovery pits are used to intercept runoff from surface-irrigated land; however, they should not be used as a substitute for good irrigation management.

Soil fertility generally is adequate for nonirrigated crops on the neutral or mildly alkaline soils in Yuma County. Under irrigation, the fertility reserve of soils can be depleted, and secondary soil amendments and trace elements are needed on some soils in addition to the primary crop nutrients. For best results, fertilizers should be applied based on soil tests and on the needs and expected yield of the crop. The Cooperative Extension Service can help to determine the kinds and amount of fertilizer to apply.

Soil drainage is not a major problem in Yuma County. The only poorly drained soils are along live streams and in low places in the sandhill valleys. The poorly drained Las Animas and Platte soils, which make up about 9,100 acres in the county, are used mainly as pasture and hayland. They are well suited to these uses.

The field crops commonly grown in the county, in order of importance, are winter wheat, corn for grain, hay, sorghum for grain, sugar beets, corn for silage, and dry beans. The acreage of sugar beets and dry beans fluctuates widely, depending on prices. Barley, oats, and spring wheat are grown to a limited extent. Millet is grown in some wheat fields made unsuitable for wheat by soil blowing in periods of drought.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include erosion control; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils

are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management (*4*). The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

rangeland

Carl S. Fonte and Harvey A. Sprock, range conservationists, Soil Conservation Service, helped prepare this section.

Since the county was settled, the acreage of rangeland in Yuma County has been reduced by nearly 50 percent through conversion to cropland. In recent years, the rangeland has been converted mainly to pastureland and cropland under irrigation management.

The average size of ranches in the county is about 2,000 acres. Many ranches are used for farm crops as well as livestock. The livestock in Yuma County mainly is cattle in cow-calf operations. Some yearlings are purchased for grazing the spring and summer forage crops.

Sound range management based on information in this soil survey and in rangeland inventories results in increased rangeland productivity (fig. 8).

The soils in Yuma County have been grouped into 13 range sites. The range sites of the sandhill areas are the Deep Sand, Choppy Sand, Sandy Plains, and Sandhill Swale.

The hardland soils are mainly in the Loamy Plains range site. The more sloping and steep hardland soils are in the Loamy Slopes range site.

Steep broken land including the rocky, gravelly, or eroded loess soils is included in the Limestone Breaks, Gravel Breaks, and Loess Breaks range sites.

The soils on bottomlands, or meadow areas, along the Arikaree River and along the North and South Forks of the Republican River are included in the Sandy Meadow, Salt Meadow, Wet Meadow, or Sandy Bottomland range sites.

The conservation practices that are effective on these range sites are sand sagebrush management, range seeding and fencing, range pitting or furrowing on the contour, water spreading, stock water development (ponds, pits, wells, springs, pipelines, and tanks), proper grazing use, and deferred grazing. Deferred grazing, if combined with well planned structural practices, can increase the total amount of usable forage more than any other single practice. It has been used extensively on rangeland in the sandhills and has been very effective.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants.

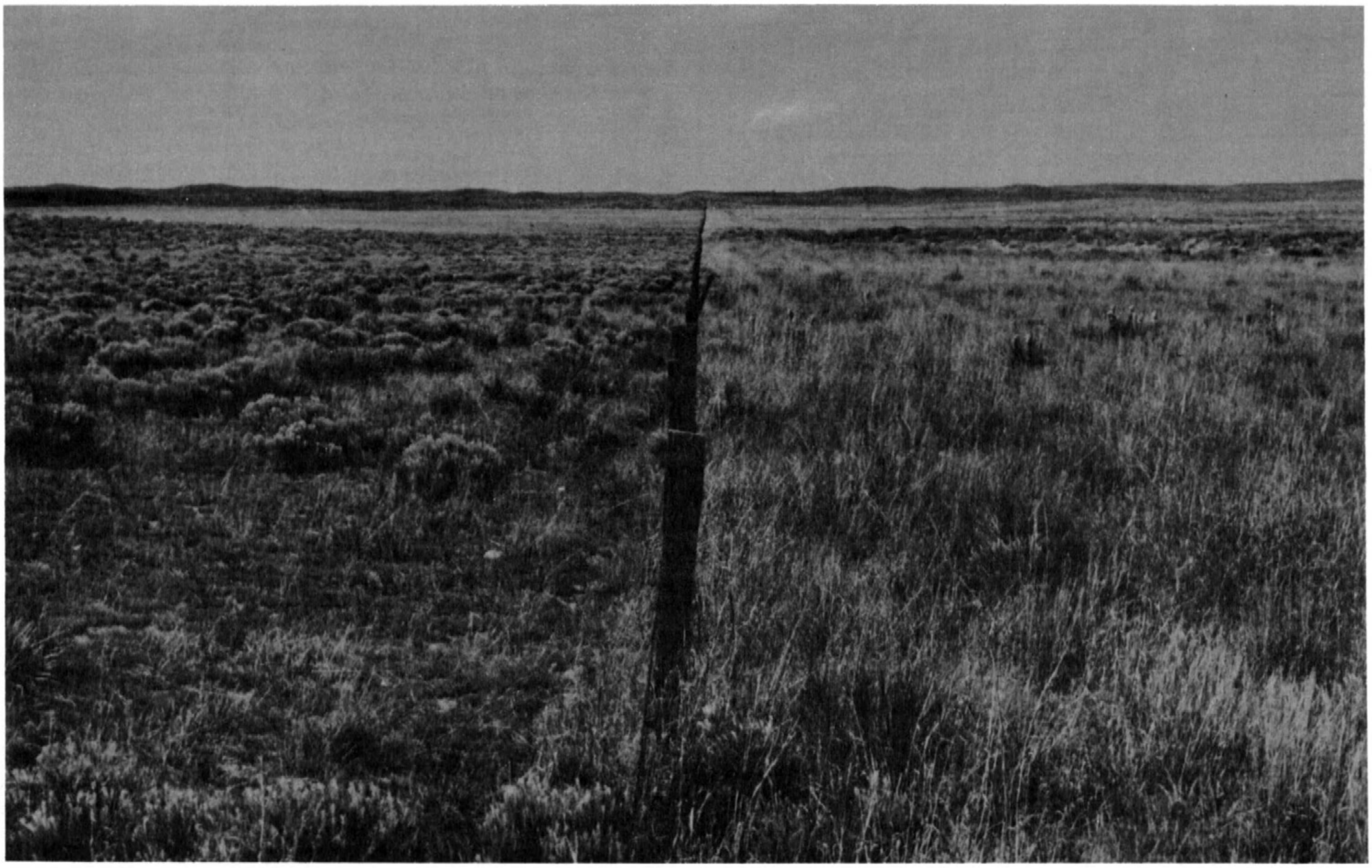


Figure 8.—Rangeland on Julesburg loamy sand, 0 to 3 percent slopes. The pasture on the right has been managed to control sagebrush and to restore the potential plant community, and thus it is more productive than the pasture on the left.

The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a

specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

woodland, windbreaks, and environmental plantings

John S. Berst, district forester, Colorado State Forest Service, and Sherman J. Finch, woodland conservationist, Soil Conservation Service, helped prepare this section.

Cottonwood is the only forest type that occurs naturally in Yuma County. It generally is found along the Republican and Arikaree Rivers. The dominant species in this forest type is plains cottonwood. Willow is included in some stands. This woodland is used as a source of firewood and for recreation, wildlife habitat, and livestock forage.

Windbreaks are widely used in Yuma County. They protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Eldie W. Mustard, state biologist, Soil Conservation Service, helped prepare this section.

Before settlement, wildlife in Yuma County was typical of that on the plains, including herds of bison and antelope and a few elk and grizzly bear. Prairie chickens inhabited the tall-grass plains. As a result of settlement and the accompanying land-use changes, bison, grizzly bear, and elk no longer inhabit the area. A few flocks of prairie chickens remain.

The changes in land use from grassland utilized by the native wildlife to grassland utilized by cattle and to dryland and irrigation farming have drastically changed the habitat for wildlife. For example, the introduction of grain farming reduced the habitat for the prairie chicken but created a habitat for the ring-necked pheasant.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible. Potentials are rated on a nonirrigated basis. Irrigation would increase the potential.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, grain sorghum, and millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bluegrass, sand lovegrass, switchgrass, bromegrass, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, cactus, yucca, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are currant, blackberry, chokecherry, and sand sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, barnyard grass, saltgrass, cordgrass, rushes, sedges, cattails, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce

grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include sandhill crane, pheasant, meadowlark, field sparrow, cottontail, and kill deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, raccoon, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, kit fox, meadowlark, and lark bunting.

engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. The information is based on observed performance of the soils and on the estimated data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large

stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils (*7*). Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering properties and classifications provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 13 gives information on the soil properties and site features that affect water management. The kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering properties

Table 14 gives estimates of the engineering classification and of the range of properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind

erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms (*5*).

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is,

perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning produced by flowing water, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. The Las Animas series is a member of the coarse-loamy, mixed (calcareous), mesic family of Typic Fluvaquents.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*3*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Albinas series

The Albinas series consists of deep, well drained soils that formed in loamy alluvium. Albinas soils are on stream terraces and flood plains along intermittent drainageways. Slopes are 0 to 2 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 50 degrees F.

Albinas soils are similar to Haxtun soils. They are near Haxtun, Paoli, Bankard, Haverson, and Rago soils. Haxtun soils have a buried horizon within a depth of 40 inches. Paoli soils are coarser textured than Albinas soils

and do not have a B2t argillic horizon. Bankard soils have a color value of 4 or more when moist. They are sandy and do not have a B2t horizon. Haverson soils have a color value of 4 or more when moist and do not have a B2t horizon. Rago soils have a buried horizon within a depth of 40 inches and are clayey in the B2t horizon.

Typical pedon of Albinas loam, in native grass about 20 miles north of Yuma, 600 feet south and 600 feet west of the northeast corner of sec. 13, T. 5 N., R. 48 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium platy structure parting to moderate fine granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

B2t—6 to 31 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate angular blocky; hard, friable, sticky and slightly plastic; few fine roots; few thin patchy clay films on faces of peds; mildly alkaline; clear wavy boundary.

Cca—31 to 64 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine roots; few fine filaments and threads of segregated lime; violently effervescent; moderately alkaline.

In some pedons thin strata of sand are in one or more horizons. In some pedons the soil is as much as 10 percent gravel. The depth to lime ranges from 20 to 40 inches. The mollic epipedon is 20 to 40 inches thick. The A horizon is neutral or mildly alkaline.

The B2t horizon ranges from clay loam to sandy clay loam. The C horizon ranges from loam to fine sandy loam.

Ascalon series

The Ascalon series consists of deep, well drained soils that formed in moderately coarse textured, wind-reworked, calcareous alluvium of the Ogallala formation. Ascalon soils are on smooth plains. Slopes range from 0 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Ascalon soils are near Platner, Manter, Julesburg, and Haxtun soils. Platner soils have a clayey B2t horizon. Julesburg and Manter soils have a sandy loam B2t horizon. Haxtun soils have a buried horizon within a depth of 40 inches.

Typical pedon of Ascalon fine sandy loam, 0 to 3 percent slopes, in a cultivated field 10 miles north and 5 miles east of Yuma, 550 feet east and 100 feet south of the northwest corner of sec. 3, T. 3 N., R. 47 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; neutral; clear smooth boundary.

B21t—6 to 12 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; common thin clay films on faces of peds; neutral; clear smooth boundary.

B22t—12 to 18 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; common thin clay films on faces of peds; neutral; clear smooth boundary.

B3ca—18 to 24 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; hard, friable, slightly sticky and plastic; few very fine and fine roots; very few thin clay films on vertical faces of peds; violently effervescent; moderately alkaline; clear smooth boundary.

C1ca—24 to 44 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; very hard, very friable, nonsticky and slightly plastic; few fine and very fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

C2—44 to 60 inches; very pale brown (10YR 7/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; very hard, very friable, nonsticky and nonplastic; violently effervescent; moderately alkaline.

The mollic epipedon is 7 to 20 inches thick. Typically, the depth to lime is 15 to 20 inches, but it ranges from 15 to 30 inches. In some pedons, the soil is as much as 15 percent gravel.

The A horizon ranges from fine sandy loam to loamy sand. It is neutral to mildly alkaline.

The B horizon is 12 to 24 inches thick. The B2 horizon is neutral or mildly alkaline.

The C horizon ranges from fine sandy loam to loamy sand. It is moderately alkaline or strongly alkaline.

Bankard series

The Bankard series consists of deep, somewhat excessively drained soils that formed in stratified sandy alluvium. Bankard soils are on flood plains and second-bottom terraces along intermittent and perennial streams. Slopes are 0 to 2 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Bankard soils are near Glenberg, Haverson, Platte, and Las Animas soils. Glenberg soils are stratified fine sandy loams. Haverson soils are stratified loam, silt

loam, and fine sandy loam, but they are predominantly loam. Platte soils are sandy and poorly drained. Las Animas soils are poorly drained, stratified sandy loams.

Typical pedon of Bankard sand, in native grass about 24 miles south of Eckley on the south streambank of the Arikaree River, 425 feet west and 340 feet north of the southeast corner of sec. 25, T. 3 S., R. 46 W.

A1—0 to 5 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common very fine, fine, and medium roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—5 to 30 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grain; loose; common very fine, fine, and medium roots; weakly effervescent; moderately alkaline; clear wavy boundary.

C2—30 to 60 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few fine and medium roots; weakly effervescent; moderately alkaline.

Bankard soils typically are calcareous; in some pedons, they are noncalcareous in the upper few inches. The C horizon ranges from sand to mixed sand and gravel.

Bayard series

The Bayard series consists of deep, well drained soils that formed in calcareous, moderately sandy material on alluvial fans and foot slopes. Slopes range from 2 to 6 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Bayard soils are similar to Manter, Paoli, Laird, and Kim soils. They are near Kim and Manter soils. Manter soils have a sandy loam B2t horizon. Paoli soils have an A horizon that is more than 20 inches thick. Laird soils have a Cca horizon that has a very high content of lime. Kim soils are loamy.

Typical pedon of Bayard fine sandy loam, 2 to 6 percent slopes, in grass about 5 miles west and 1 mile south of Wray, 800 feet south and 800 feet east of the northwest corner of sec. 17, T. 1 N., R. 44 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; mildly alkaline; clear smooth boundary.

AC—5 to 15 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; common very fine and fine roots; mildly alkaline; clear wavy boundary.

C1ca—15 to 21 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; violently effervescent; few fine rounded masses of lime; moderately alkaline; clear wavy boundary.

C2ca—21 to 36 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; violently effervescent; few medium soft masses of lime; gradual wavy boundary.

C3—36 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; few very fine and fine roots; violently effervescent; moderately alkaline.

The thickness of the mollic epipedon is 8 to 20 inches. The content of gravel and pebbles ranges from 0 to 15 percent. The A horizon is neutral or mildly alkaline. The depth to lime ranges from 8 to 18 inches.

Canyon series

The Canyon series consists of shallow, well drained soils that formed in calcareous, loamy material that weathered from highly calcareous sandstone. Canyon soils are on hills, knolls, and ridges. Slopes range from 1 to 25 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Canyon soils are near Kim, Bayard, Colby, and Midway soils. Kim soils are deep and loamy. Bayard soils are deep fine sandy loams. Colby soils are deep and silty. Midway soils are shallow and clayey.

Typical pedon of Canyon loam, in an area of Canyon-Dioxice complex, 1 to 9 percent slopes, in native grass about 19 miles north of Yuma, 390 feet south and 20 feet east of the northwest corner of sec. 14, T. 5 N., R. 48 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

AC—5 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

C1ca—8 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and

slightly plastic; many very fine and fine roots; violently effervescent; moderately alkaline; clear wavy boundary.

Cr2—12 inches; white (10YR 8/1) highly calcareous sandstone, light gray (10YR 7/2) moist; somewhat layered and fractured.

The content of rock fragments in the pedon ranges from 0 to 25 percent. Depth to bedrock ranges from 6 to 20 inches.

The A horizon is fine sandy loam or loam.

Colby series

The Colby series consists of deep, well drained soils that formed in wind-deposited silt and very fine sand. Colby soils are on irregular plains, low hills, and dissected slopes. Slopes range from 3 to 25 percent. The mean annual precipitation is 16 inches, and the mean annual temperature is 51 degrees F.

Colby soils are similar to Kim soils. They are near Kim, Canyon, Keith, and Kuma soils. Kim soils are more than 15 percent fine sand or coarser sand in the control section. Canyon soils are shallow. Keith and Kuma soils have a mollic epipedon and a B2t horizon.

Typical pedon of Colby silt loam, 3 to 6 percent slopes, in native grass 1 mile east and 1 mile south of Vernon, 75 feet west and 1,700 feet south of the northeast corner of sec. 33, T. 1 S., R. 44 W.

A1—0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; weakly effervescent; mildly alkaline; clear smooth boundary.

AC—5 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C1ca—8 to 17 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; fine filaments, threads, and soft masses of segregated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C2ca—17 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine and fine roots; violently effervescent; fine filaments, threads, and soft masses of segregated lime; moderately alkaline.

In some pedons, lime is leached to a depth of 6 inches.

The C2 horizon ranges from silt loam to loam, depending on the content of very fine sand. In the Cca horizon, visible accumulations of carbonates occur as fine filaments, threads, or soft masses. Carbonate accumulations are not visible in all pedons.

Dailey series

The Dailey series consists of deep, somewhat excessively drained soils that formed in wind-deposited sand. Dailey soils are in sandhill valleys and on sandhills. Slopes are 0 to 6 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Dailey soils are near Valent, Julesburg, Haxtun, and Manter soils. Valent soils have a light-colored surface layer. Julesburg soils have a B2t horizon of coarse sandy loam. Manter soils have a B2t horizon of sandy loam, and they have a calcareous substratum. Haxtun soils have a buried B2tb horizon of sandy clay loam.

Typical pedon of Dailey loamy sand, in native grass, 5 miles south and 4 miles east of Yuma, 2,000 feet west and 500 feet east of the southeast corner of sec. 30, T. 1 S., R. 47 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure that parts to single grain; soft, very friable; common very fine and fine roots; neutral; clear wavy boundary.

AC—5 to 12 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure that parts to single grain; slightly hard, very friable; common very fine and fine roots; very few very thin clay films on vertical faces of peds; neutral; clear wavy boundary.

C1—12 to 25 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist; single grain; loose; few very fine and fine roots; neutral; gradual smooth boundary.

C2—25 to 36 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grain; loose; few very fine roots; neutral; gradual smooth boundary.

C3—36 to 60 inches; pale brown (10YR 6/3) sand, dry or moist; single grain; loose; neutral.

The C horizon is loamy sand or sand. In some pedons, a layer of grayish brown sandy loam is below a depth of 40 inches. To a depth of 40 inches or more, the soil is neutral or mildly alkaline.

Dioxice series

The Dioxice series consists of deep, well drained soils that formed in old alluvium. Dioxice soils are on side slopes of limestone hills and knolls. Slopes range from 3 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Dioxice soils are similar to Kim soils and are near Canyon soils. Kim soils have underlying material that is less than 15 percent lime carbonate. Canyon soils are shallow. In Yuma County, the Dioxice soils are mapped in a complex with Canyon soils.

Typical pedon in an area of Canyon-Dioxice complex, 1 to 9 percent slopes, in a cultivated field 15 miles north and 8 miles east of Yuma, 1,000 feet north and 15 feet east of the southwest corner of sec. 31, T. 5 N., R. 46 W.

A11—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; 5 percent gravel-sized fragments of limestone; neutral; clear wavy boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; 10 percent gravel-sized fragments of limestone; strongly effervescent; moderately alkaline; clear irregular boundary.

B2t—9 to 24 inches; light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; common very fine and fine roots; 5 percent gravel-sized fragments of limestone; violently effervescent; moderately alkaline; clear wavy boundary.

C1ca—24 to 35 inches; white (10YR 8/2) sandy clay loam, very pale brown (10YR 7/4) moist; moderate medium platy structure; very hard, friable, slightly sticky and plastic; few very fine and fine roots; 5 percent gravel-sized fragments of limestone; visible lime disseminated in soil mass; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—35 to 60 inches; pinkish white (7.5YR 8/2) sandy clay loam, pink (7.5YR 7/4) moist; massive; very hard, friable, very sticky and very plastic; 10 percent gravel; moderately alkaline; calcareous.

The mollic epipedon is 8 to 10 inches thick. The depth to the Cca horizon is 24 to 40 inches. The content of gravel-sized rock fragments in the pedon ranges from 0 to 15 percent.

Dwyer series

The Dwyer series consists of deep, excessively drained soils that formed in eolian sand. Dwyer soils are on low sandhills. Slopes range from 3 to 9 percent. The mean annual precipitation is 16 inches, and the mean annual temperature is 51 degrees F.

Dwyer soils are similar to Valent soils and are near Vona soils. Valent soils do not have lime within a depth of 40 inches. Vona soils have a B2t horizon of fine sandy loam.

Typical pedon of Dwyer loamy sand, in an area of Dwyer-Vona loamy sands, 3 to 9 percent slopes, in native range about 8 miles south and 1 mile west of Idalia, 300 feet west and 600 feet north of the center of sec. 32, T. 5 S., R. 44 W.

A1—0 to 4 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; weak coarse granular structure; soft, very friable; common fine and medium roots; mildly alkaline; clear wavy boundary.

AC—4 to 12 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; common fine and medium roots; mildly alkaline; clear wavy boundary.

C1—12 to 30 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable; few fine and medium roots; few irregularly shaped threads of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grain; loose; violently effervescent; moderately alkaline.

The A horizon is mildly alkaline or moderately alkaline. In some pedons, the surface layer is calcareous; in most pedons, lime is leached to a depth between 10 and 20 inches.

Eckley series

The Eckley series consists of deep, well drained soils that formed in gravelly alluvium. Eckley soils are on dissected alluvial terraces. Slopes range from 3 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Eckley soils are near Platner and Ascalon soils. Platner soils are more than 35 percent clay in the B2t horizon. Ascalon soils are less than 35 percent rock fragments throughout.

Typical pedon of Eckley gravelly sandy loam, 3 to 7 percent slopes, in a cultivated field 20 miles north and 6 miles east of Yuma, 30 feet east and 1,000 feet north of the southwest corner of sec. 2, T. 5 N., R. 47 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse platy structure parting to moderate medium granular; hard, friable, slightly sticky and plastic; common very fine and fine roots; 15 percent gravel; neutral; clear smooth boundary.

B2t—5 to 15 inches; brown (7.5YR 5/2) gravelly sandy clay loam; dark brown (7.5YR 3/2) moist; moderate medium angular blocky structure; extremely hard, firm, sticky and very plastic; common very fine and

fine roots; continuous thin clay films on faces of peds; 15 percent gravel; neutral; gradual wavy boundary.

IIC1—15 to 31 inches; light brown (7.5YR 7/4) gravelly sand; single grain; loose; few very fine roots; 35 percent gravel; neutral; clear wavy boundary.

IIC2ca—31 to 47 inches; pink (7.5YR 7/4) gravelly sand, brown (7.5YR 5/4) moist; single grain; loose; few very fine roots; 35 percent gravel; visible carbonates crusted on the bottom of pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3ca—47 to 60 inches; pink (7.5YR 7/4) gravelly sand, brown (7.5YR 5/2) moist; single grain; loose; 35 percent gravel; visible carbonates crusted on the bottom of pebbles, less than in IIC2ca horizon; violently effervescent; moderately alkaline.

The mollic epipedon is 9 to 16 inches thick. The depth to the contrasting IIC horizon is 12 to 20 inches.

Glenberg series

The Glenberg series consists of deep, well drained soils that formed in alluvium. Glenberg soils are on second-bottom terraces and flood plains. Slopes are less than 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Glenberg soils are near Haverson, Bankard, and Las Animas soils. Haverson soils are loamy. Bankard soils are sandy. Las Animas soils are poorly drained.

Typical pedon of Glenberg fine sandy loam, in an area of Glenberg-Bankard complex, in irrigated pasture about 2 miles west of Wray, 1,050 feet north and 1,600 feet east of the southwest corner of sec. 2, T. 1 N., R. 44 W.

Ap—0 to 8 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1—8 to 24 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, nonsticky and nonplastic; very friable, common very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C2ca—24 to 60 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; violently effervescent; fine seams and threads of lime; moderately alkaline.

In some pedons, the soil is underlain by sand at a depth of more than 40 inches.

The C2 horizon commonly is stratified with thin lenses of sand, sandy clay loam, and loam. In some pedons, it has a few common strong brown and reddish brown mottles.

Haverson series

The Haverson series consists of deep, well drained soils that formed in alluvium. Haverson soils are on second-bottom terraces and flood plains. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Haverson soils are near Glenberg, Bankard, and Las Animas soils. Glenberg soils have a C horizon of fine sandy loam. Bankard soils are sandy. Las Animas soils are poorly drained sandy loams.

Typical pedon of Haverson loam, in native grass, about 3 miles west of Wray, 1,584 feet west and 1,320 feet north of the southeast corner of sec. 9, T. 1 W., R. 44 W.

A11—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine granular structure; soft, friable, nonsticky and slightly plastic; common very fine and fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

AC—4 to 14 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thick platy structure parting to weak moderate subangular blocky; slightly hard, friable, nonsticky and slightly plastic; common very fine and fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

C1—14 to 36 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; slightly hard, friable, nonsticky and slightly plastic; few very fine and fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

C2—36 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; violently effervescent; strongly alkaline.

In some pedons, the soil is as much as 15 percent gravel throughout.

The C horizon is stratified and ranges from fine sandy loam to silty clay loam; the average texture is loam.

Haxtun series

The Haxtun series consists of deep, well drained soils that formed in wind-reworked sandy material overlying a buried soil. Haxtun soils are in swales on plains and in sandhill valleys. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Haxtun soils are similar to Albinas soils. They are near Julesburg, Manter, and Dailey soils. Albinas, Julesburg,

Manter, and Dailey soils do not have a buried horizon. Julesburg and Manter soils have a thinner mollic epipedon than Haxtun soils and have a B2t horizon of sandy loam. Dailey soils have a thinner mollic epipedon and are sandy.

Typical pedon of Haxtun loamy sand, in a cultivated field about 5 miles south of Eckley, 105 feet north and 270 feet west of the southeast corner of sec. 23, T. 1 N., R. 46 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A12—6 to 10 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, very friable; neutral; clear smooth boundary.

B11—10 to 14 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; common thin clay films on faces of peds; neutral; clear smooth boundary.

B12—14 to 20 inches; dark grayish brown (10YR 4/2) sandy loam; very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, nonsticky and slightly plastic; common very fine and fine roots; common thin clay films on faces of peds; neutral; clear smooth boundary.

B2tb—20 to 33 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, slightly sticky and plastic; common very fine and fine roots; many thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3b—33 to 41 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; common very fine and fine roots; common thin clay films on faces of peds; mildly alkaline; gradual smooth boundary.

C1b—41 to 52 inches; very pale brown (10YR 7/3) sandy loam; brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine and fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2cab—52 to 60 inches; very pale brown (10YR 8/3) sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; violently effervescent; moderately alkaline.

The depth to calcareous material ranges from 23 to 60 inches. The depth to the base of the B2tb horizon ranges from 25 to 44 inches. The A and B horizons are neutral to mildly alkaline. The B2tb and B3b horizons are mildly alkaline to moderately alkaline.

Iliff series

The Iliff series consists of moderately deep, well drained soils that formed in loess overlying limestone. Iliff soils are on smooth plains. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Iliff soils are similar to Platner soils. They are near Platner, Canyon, and Dioxice soils. Platner soils are deep. Canyon soils are shallow. Dioxice soils are deep and are less than 35 percent clay in the B2t horizon.

Typical pedon of Iliff loam, in native grass about 7 miles north and 6 miles east of Yuma, 300 feet south and 3 feet east of the north quarter corner of sec. 15, T. 3 N., R. 47 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; mildly alkaline; clear smooth boundary.

A3—3 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few thin clay films lining pores; mildly alkaline; abrupt wavy boundary.

B2t—6 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong fine angular blocky; very hard, firm, sticky and plastic; common very fine and fine roots; continuous thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B3ca—14 to 18 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; few thin clay films on faces of peds; violently effervescent; moderately alkaline; gradual wavy boundary.

Cca—18 to 26 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; violently effervescent; moderately alkaline; abrupt wavy boundary.

R—26 inches; hard limestone of the Ogallala Formation.

The mollic epipedon is 8 to 14 inches thick. The depth to lime is 14 to 21 inches. Limestone is at a depth of 20 to 40 inches. The soil is neutral to moderately alkaline.

Inavale series

The Inavale series consists of deep, somewhat excessively drained soils that formed in eolian sand. Inavale soils are in sandhill valleys. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Inavale soils are similar to Bankard soils. They are near Valent, Dailey, and Haxtun soils. Bankard soils are stratified and are on flood plains. Platte soils are poorly drained. Valent soils are excessively drained. Dailey soils have a surface layer that is 10 or more inches thick and has color value of 3 or less when moist.

Typical pedon of Inavale loamy sand, in native grass about 14 miles north and 2 miles east of Laird, 700 feet east and 200 feet north of the southwest corner of the northeast quarter of sec. 28, T. 4 N., R. 42 W.

A11—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark brown (10YR 3/2) moist; moderate medium granular structure parting to moderate very fine granular; slightly hard, very friable; many very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

A12—7 to 11 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; many very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

AC—11 to 16 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; few very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C1—16 to 38 inches; light gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; common medium distinct brownish yellow (10YR 6/6) and dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure; hard, very friable; few very fine and fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2ca—38 to 52 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3—52 to 60 inches; gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; common medium distinct dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; violently effervescent; moderately alkaline.

In some pedons, the soil is noncalcareous.

The A horizon is neutral to moderately alkaline.

The C horizon ranges from loamy fine sand to fine sand. It has few to common, faint to distinct, coarse to medium, brownish yellow to dark yellowish brown mottles. The C horizon is neutral to moderately alkaline.

Julesburg series

The Julesburg series consists of deep, well drained soils that formed in eolian sand. Julesburg soils are on smooth plains. Slopes range from 0 to 7 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Julesburg soils are similar to and are near Manter and Vona soils. Manter soils are calcareous within a depth of 40 inches. When moist, Vona soils have a color value brighter than 3 in the surface layer. They are calcareous within a depth of 40 inches.

Typical pedon of Julesburg loamy sand, 3 to 7 percent slopes, in native grass about 4 miles south of Yuma, 100 feet east and 35 feet south of the northwest corner of sec. 14, T. 1 N., R. 48 W.

A11—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; common very fine and fine roots; neutral; clear smooth boundary.

A12—7 to 11 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, friable; common very fine and fine roots; neutral; clear smooth boundary.

B2t—11 to 19 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 4/3) moist; moderate coarse subangular blocky structure; soft, firm, nonsticky and slightly plastic; common very fine and fine roots; neutral; clear smooth boundary.

C1—19 to 35 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; neutral; clear boundary.

C2—35 to 60 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral.

The mollic epipedon is 7 to 20 inches thick. The depth to calcareous material ranges from 50 to more than 60 inches. The gravel content ranges from 0 to 15 percent by volume, but typically is 0 to 5 percent.

The C horizon ranges from loamy sand to sand. It is neutral or mildly alkaline.

Keith series

The Keith series consists of deep, well drained soils that formed in loess. Keith soils are on smooth plains.

Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Keith soils are similar to and are near Richfield and Kuma soils. Richfield soils are more than 35 percent clay in the B2t horizon. Kuma soils have a buried horizon. In Yuma County, the Keith soils are mapped in a complex with Kuma soils.

Typical pedon of Keith silt loam, in an area of Kuma-Keith silt loams, in a cultivated field about 21 miles south of Laird, 978 feet east and 198 feet north of the southwest corner of sec. 19, T. 3 S., R. 42 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and slightly plastic; neutral; abrupt smooth boundary.

B2t—4 to 15 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak medium and coarse subangular blocky; very hard, firm, slightly sticky and plastic; common very fine and fine roots; common thin clay films on faces of peds; neutral; clear smooth boundary.

B3ca—15 to 25 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm, nonsticky and slightly plastic; few very fine and fine roots; violently effervescent; moderately alkaline; clear wavy boundary.

C1ca—25 to 40 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, friable, nonsticky and slightly plastic; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—40 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and slightly plastic; violently effervescent; moderately alkaline.

The mollic epipedon is 8 to 20 inches thick. The depth to calcareous material ranges from 15 to more than 30 inches. The Ap and B2t horizons are neutral or mildly alkaline.

The B2t horizon is silt loam or silty clay loam.

The C horizon is silt loam or very fine sandy loam.

Kim series

The Kim series consists of deep, well drained soils that formed in alluvium of limestone and shale material mixed with loess. Kim soils are moderately sloping and are on alluvial fans and foot slopes below escarpments of limestone and sedimentary rock. Slopes range from 3 to 6 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Kim soils are similar to Bayard and Colby soils. They are near Bayard, Razor, Midway, and Canyon soils. Bayard soils are sandy and have color value of 3 or less in the surface layer when moist. Colby soils are silty and are less than 15 percent fine or coarser sand. Razor and Midway soils are clayey. Midway and Canyon soils are shallow.

Typical pedon of Kim loam, 3 to 6 percent slopes, in native grass about 11 miles south and 2 miles east of Laird, 50 feet east and 2,600 feet south of the northwest corner of sec. 34, T. 1 S., R. 42 W.

A—0 to 7 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thick platy structure parting to weak coarse granular; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; strongly effervescent; moderately alkaline; clear smooth boundary.

AC—7 to 16 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; violently effervescent; clear smooth boundary.

C1—16 to 33 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common very fine and fine roots; violently effervescent; few small round masses of segregated lime; moderately alkaline; gradual wavy boundary.

C2—33 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; violently effervescent; moderately alkaline.

Kim soils are underlain by shale or limestone generally at a depth of more than 60 inches.

The C1 horizon ranges from loam to light clay loam. Segregated lime in the C1 horizon is not continuous. The C2 horizon ranges from light clay loam to heavy clay loam.

Kuma series

The Kuma series consists of deep, well drained soils that formed in loess. Kuma soils are on smooth plains. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Kuma soils are similar to and are near Richfield and Keith soils. Richfield and Keith soils do not have a buried horizon. Richfield soils are more than 35 percent clay in the B2t horizon.

Typical pedon of Kuma silt loam, in an area of Kuma-Keith silt loams, in a cultivated field about 3 miles south of Wray, 1,520 feet west and 2,440 feet south of the northeast corner of sec. 25, T. 1 N., R. 44 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate

medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline; clear smooth boundary.

B2t—10 to 17 inches; grayish brown (10YR 3/2) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; common very fine and fine roots; thin clay films on the faces of peds; moderately alkaline; clear smooth boundary.

B21tb—17 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2.5/2) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; common very fine and fine roots; common thin clay films on faces of peds; fine filaments of lime; moderately alkaline; clear smooth boundary.

B22tcab—24 to 30 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; few thin clay films on faces of peds; few fine filaments of lime; violently effervescent; moderately alkaline; clear smooth boundary.

C1ca—30 to 48 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few thin clay films on faces of peds; few fine filaments of lime; violently effervescent; moderately alkaline; clear smooth boundary.

C2ca—48 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine filaments of lime; violently effervescent; moderately alkaline.

The mollic epipedon is 20 to 50 inches thick. Depth to lime ranges from 17 to 40 inches. The Ap and B2t horizons are neutral and moderately alkaline.

The B2t horizon ranges from silt loam to silty clay loam. The B2t horizon ranges from loam to silty clay loam.

The C horizon ranges from silt loam to loam.

Laird series

The Laird series consists of deep, well drained soils that formed in wind-reworked alluvium. Laird soils are in sandhill valleys. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Laird soils are similar to Bayard soils. They are near Haxtun, Inavale, and Manter soils. Bayard soils are less than 15 percent calcium carbonate in the Cca horizon. Haxtun and Manter soils have a B2t horizon overlying the Cca horizon. Inavale soils are sandy and are less than 15 percent carbonate.

Typical pedon of Laird fine sandy loam, in a cultivated field about 15 miles north of Wray, 150 feet north and 2,500 feet east of the southwest corner of sec. 14, T. 4 N., R. 44 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam; very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, very friable, nonsticky and nonplastic; weakly effervescent; moderately alkaline; clear wavy boundary.

A12—7 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure parting to moderate medium granular; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

AC—18 to 27 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; violently effervescent; moderately alkaline; clear wavy boundary.

IIC1ca—27 to 46 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; few medium soft masses of calcium carbonates; very strongly effervescent; moderately alkaline; clear wavy boundary.

C2—46 to 60 inches; light gray (5Y 7/2) loamy fine sand, olive gray (5Y 5/2) moist; common medium distinct pale yellow (5Y 7/4) mottles, olive (5Y 5/4) moist; single grain; loose; strongly effervescent; moderately alkaline.

The mollic epipedon is 6 to 20 inches thick. The IICca horizon ranges from moderately alkaline to strongly alkaline. The depth to the IIC2 horizon is 30 to 48 inches. Where this soil is in native vegetation, it is free of lime to a depth of 6 inches.

Las Animas series

The Las Animas series consists of deep, poorly drained soils that formed in alluvium. Las Animas soils are on flood plains of streams. Slopes are 0 to 2 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Las Animas soils are near Glenberg, Haverson, and Platte soils. Glenberg and Haverson soils are well drained. Platte soils are sandy.

Typical pedon of Las Animas fine sandy loam, in native grass about 7 miles south and 1 mile west of Idalia, 898 feet south and 1,056 feet west of the northeast corner of sec. 29, T. 5 S., R. 44 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable,

nonsticky and slightly plastic; many very fine and fine roots; slightly effervescent; moderately alkaline; clear wavy boundary.

C1g—7 to 24 inches; light gray (2.5 7/2) sandy loam, grayish brown (2.5Y 5/2) moist; few fine faint light yellowish brown (2.5Y 6/4) mottles, olive brown (2.5Y 4/4) moist; weak thick platy structure; hard, very friable, nonsticky and nonplastic; common very fine roots; fine rounded soft masses of fine salt crystals; strongly effervescent; strongly alkaline; clear irregular boundary.

C2g—24 to 34 inches; light gray (2.5Y 7/2) sandy loam, grayish brown (2.5Y 5/2) moist; common medium distinct brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; weak thick platy structure; hard, very friable, nonsticky and nonplastic; common very fine roots; fine rounded masses of salt crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

C3g—34 to 51 inches; gray (10YR 6/1) coarse sandy loam, very dark gray (10YR 3/1) moist; common medium faint dark yellowish brown (10YR 3/4) mottles, moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; fine filaments and threads of salt crystals; strongly effervescent; moderately alkaline; clear wavy boundary.

C4g—51 to 60 inches; gray (10YR 5/1) coarse sand, very dark gray (10YR 3/1) moist; single grain; loose; slightly effervescent; moderately alkaline.

The soil is stratified and ranges from very fine sandy loam to sand. The depth to the Cg horizon ranges from 4 to 37 inches. The average texture of a mixed sample of the soil material between depths of 10 and 40 inches is sandy loam. The C2 and C3 horizons range from moderately alkaline to strongly alkaline.

Manter series

The Manter series consists of deep, well drained soils that formed in eolian sand. Manter soils are on smooth plains. Slopes range from 0 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Manter soils are similar to Julesburg and Vona soils. They are near Julesburg, Ascalon, Haxtun, and Valent soils. Julesburg soils are free of lime to a depth of more than 40 inches. When moist, Vona soils have color value brighter than 3 in the surface layer. Ascalon soils have a B2t horizon of sandy clay loam. Haxtun soils have a buried B2t horizon of sandy clay loam. Valent soils are sandy.

Typical pedon of Manter sandy loam, 2 to 5 percent slopes, in native grass about 3 miles south of Yuma, 200 feet north and 20 feet west of the southeast corner of sec. 3, T. 1 N., R. 48 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; neutral; clear smooth boundary.

B2t—6 to 18 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; few thin clay films on faces of peds; neutral; clear smooth boundary.

B3—18 to 28 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine and fine roots; very few thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Cca—28 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, very friable, nonsticky and slightly plastic; violently effervescent; lime disseminated and in fine soft masses; moderately alkaline.

The mollic epipedon is 7 to 19 inches thick. Depth to lime ranges from 12 to 40 inches. The content of coarse fragments in the pedon typically is 0 to 5 percent but ranges to 15 percent. The A and B2t horizons are neutral or mildly alkaline.

The C horizon ranges from loamy sand to sandy loam. The content of lime in the Cca horizon ranges from 5 to 45 percent.

Midway series

The Midway series consists of shallow, well drained soils that formed in clayey material that weathered from calcareous platy shale. Midway soils are on ridge crests of dissected slopes. Slopes range from 3 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Midway soils are near Razor and Canyon soils. Razor soils are clayey and are moderately deep to shale. Canyon soils are loamy and are shallow to limestone. In Yuma County, the Midway soils are mapped in a complex with Razor soils.

Typical pedon of Midway silty clay loam, in an area of Razor-Midway complex, 3 to 9 percent slopes, in native grass about 1 mile southwest of Laird, 1,700 feet west and 685 feet south of the northeast corner of sec. 12, T. 1 N., R. 43 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

AC—4 to 13 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

Cr—13 inches; light brownish gray (2.5YR) clay shale, dark grayish brown (10YR 4/2) moist; thin platy structure; gypsum crystals between the plates; few very fine and fine roots between the plates; violently effervescent; moderately alkaline.

The depth to shale is 6 to 20 inches.

Paoli series

The Paoli series consists of deep, well drained soils that formed in alluvium. Paoli soils are on second-bottom terraces and flood plains along intermittent streams. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Paoli soils are near Albinas and Bankard soils. Albinas soils have a B2t horizon of clay loam. Bankard soils are sandy and have a surface layer that has color value brighter than 3 when moist.

Typical pedon of Paoli sandy loam, in grass about 15 miles north and 1 mile east of Yuma, 1,060 feet east and 2,840 feet south of the northwest corner of sec. 1, T. 4 N., R. 48 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak medium granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; 10 percent gravel; mildly alkaline; clear smooth boundary.

AC—5 to 32 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, very friable, nonsticky and nonplastic; common very fine and fine roots; 10 percent gravel; mildly alkaline; clear wavy boundary.

Cca—32 to 60 inches; light brownish gray (10YR 6/2) coarse sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; violently effervescent; visible lime disseminated and in fine soft masses; moderately alkaline.

The content of fine gravel in the pedon ranges from 0 to about 15 percent. The depth to lime is 25 to 40 inches. In some pedons, strata of sand and fine gravel are in the substratum below a depth of 32 inches.

Platner series

The Platner series consists of deep, well drained soils that formed in loess-capped old alluvium. Platner soils are on smooth plains. Slopes range from 0 to 5 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Platner soils are near Ascalon and Richfield soils. Ascalon soils have a B2t horizon of sandy clay loam. Richfield soils have a B2t horizon of silty clay loam.

Typical pedon of Platner loam, in a cultivated field about 20 miles north of Yuma, 2,500 feet east and 120 feet south of the northwest corner of sec. 11, T. 5 N., R. 48 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and plastic; 5 percent fine gravel; neutral; abrupt smooth boundary.

B21t—6 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine prismatic structure parting to moderate fine angular blocky; very hard, firm, sticky and very plastic; common very fine and fine roots; many thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22t—13 to 16 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate fine prismatic structure parting to moderate fine angular blocky; hard, friable, sticky and very plastic; common very fine and fine roots; many thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3ca—16 to 19 inches; pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; few thin clay films on faces of peds; violently effervescent; moderately alkaline; clear wavy boundary.

C1ca—19 to 36 inches; very pale brown (10YR 7/3) loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky and plastic; few very fine and fine roots; 5 percent gravel; violently effervescent; common fine seams of lime; moderately alkaline; gradual wavy boundary.

C2—36 to 50 inches; very pale brown (10YR 7/3) gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, nonsticky and slightly plastic; 20 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

C3—50 to 60 inches; pink (7.5YR 7/4) gravelly sand, strong brown (7.5YR 5/6) moist; massive; hard, very friable, slightly plastic; 30 percent gravel; violently effervescent; moderately alkaline.

The mollic epipedon is 7 to 18 inches thick. The depth to lime is 8 to 24 inches.

The A horizon is sandy loam or loam. The content of coarse fragments, which are mostly fine gravel, ranges to 10 percent. The A horizon is neutral or mildly alkaline.

The B2t horizon is neutral or mildly alkaline.

The C1ca and C2 horizons range from fine sandy loam to sandy clay loam. In some pedons they are gravelly and are 5 to 20 percent pebbles. The C3 horizon ranges from gravelly sandy clay loam to gravelly sand. It is stratified and has a wavy or irregular boundary.

Platte series

The Platte series consists of deep, poorly drained soils that formed in sandy alluvium. Platte soils are on flood plains along streams. Slopes are less than 2 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Platte soils are near Bankard, Haverson, Glenberg, and Las Animas soils. Bankard soils are somewhat excessively drained. Haverson soils are well drained loams. Glenberg soils are well drained sandy loams. Las Animas soils are poorly drained sandy loams.

Typical pedon of Platte fine sandy loam, in native grass about 7 miles north and 1 mile west of Idalia, 1,000 feet north and 200 feet east of the southeast corner of sec. 8, T. 3 S., R. 44 W.

A11—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; violently effervescent; moderately alkaline; clear abrupt boundary.

AC—6 to 13 inches; pale brown (10YR 6/3) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; common very fine, fine, and medium roots; strongly effervescent; moderately alkaline; clear smooth boundary.

C—13 to 60 inches; light brownish gray (10YR 6/2) gravelly coarse sand, grayish brown (10YR 5/2) moist; common fine distinct mottles, yellowish brown (10YR 5/4) moist; single grain; loose; common fine and medium roots; 20 percent gravel; strongly effervescent; moderately alkaline.

The depth to coarse sand or gravelly sand is 12 to 20 inches. Reaction in the pedon ranges from mildly alkaline to moderately alkaline. In spring, a water table is between depths of 2 and 6 feet.

The AC horizon ranges from loam to sand.

The C horizon has chroma of 1 to 3. Soils that have a matrix chroma of 3 commonly have mottles that have chroma of 1.

Rago series

The Rago series consists of deep, well drained soils that formed in loess. Rago soils are on slightly concave or level slopes on smooth plains or on flood plains along intermittent streams. Slopes are less than 2 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Rago soils are near Platner and Richfield soils. Platner and Richfield soils do not have a buried horizon.

Typical pedon of Rago loam, in a cultivated field about 5 miles north and 1 mile east of Yuma, 2,270 feet west and 120 feet north of the southeast corner of sec. 19, T. 3 N., R. 47 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B1—8 to 14 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and very plastic; common very fine and fine roots; few thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B21t—14 to 20 inches; dark grayish brown (10YR 4/2) heavy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to strong fine angular blocky; very hard, friable, sticky and very plastic; common very fine and fine roots; common thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B22tcab—20 to 29 inches; very dark grayish brown (10YR 3/2) heavy silty clay loam, very dark brown (10YR 2.5/2) moist; weak medium prismatic structure parting to moderate fine angular blocky; very hard, friable, sticky and very plastic; common very fine and fine roots; common thin clay films on faces of peds; partial coatings of lime on the faces of some peds; slightly effervescent; moderately alkaline; clear wavy boundary.

C1cab—29 to 37 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and plastic; about 20 percent of this horizon is insect burrowings and root channels that are filled with soil from the B22tb horizon; common very fine and fine roots; medium-sized irregular soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

C2b—37 to 54 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; few fine distinct yellowish brown (10YR 5/4) mottles, moist; massive; soft, very friable, slightly sticky and plastic; few fine roots; violently effervescent; moderately alkaline; clear wavy boundary.

C3b—54 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; common medium distinct yellowish brown (10YR 5/4) mottles, moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline.

The mollic epipedon is 24 to more than 40 inches thick. The depth to the Cca horizon is 24 to 40 inches. The content of pebbles in the pedon is 0 to 5 percent.

The A horizon is loam or clay loam.

The B22tcab horizon is at a depth of 17 to 32 inches.

Razor series

The Razor series consists of moderately deep, well drained soils that formed in clayey material that weathered from calcareous platy shale. Razor soils are on side slopes of drainageways on dissected slopes. Slopes range from 3 to 9 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Razor soils are near Midway and Kim soils. Midway soils are shallow to shale. Kim soils are deep loams.

Typical pedon of Razor clay loam, in an area of Razor-Midway complex, 3 to 9 percent slopes, in native grass about 13 miles south of Laird, 800 feet south and 2,140 feet west of the northwest corner of sec. 9, T. 2 S., R. 42 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, firm, slightly sticky and plastic; common very fine and fine roots; mildly alkaline; clear smooth boundary.

B2—4 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and very plastic; common very fine and fine roots; mildly alkaline; clear smooth boundary.

C1ca—13 to 28 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak fine prismatic structure parting to moderate fine angular blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; medium generally rounded soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

Cr2—28 inches; platy clay shale; few very fine and fine roots between shale fragments; violently effervescent.

The depth to shale ranges from 20 to 40 inches.

Richfield series

The Richfield series consists of deep, well drained soils that formed in loess. Richfield soils are on smooth plains. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Richfield soils are near Rago, Platner, and Colby soils. Rago soils have a buried horizon. Platner soils have an abrupt boundary between the A and B horizons. Colby soils are silty and do not have a B2t horizon.

Typical pedon of Richfield silt loam, in native grass about 6 miles north of Yuma, 2,540 feet east and 200 feet north of the southwest corner of sec. 15, T. 3 N., R. 48 W.

A1—0 to 3 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; neutral; abrupt smooth boundary.

B1—3 to 10 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure; very hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; continuous thin clay films on faces of peds; neutral; clear wavy boundary.

B2t—10 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong fine prismatic structure parting to strong medium angular blocky; very hard, friable, sticky and plastic; common very fine and fine roots; continuous thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

B3tca—19 to 28 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common thin clay films on faces of peds; strongly effervescent; moderately alkaline; clear wavy boundary.

Cca—28 to 60 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; hard, very friable, nonsticky and slightly plastic; violently effervescent; strongly alkaline.

The mollic epipedon is 10 to 20 inches thick. The A1 and B1 horizons are neutral or mildly alkaline. The depth to calcareous material ranges from 10 to 20 inches.

The B2t horizon is silty clay loam or silty clay.

Stoneham series

The Stoneham series consists of deep, well drained soils that formed in wind-reworked alluvium. Stoneham soils are on smooth plains. Slopes are 0 to 3 percent. The mean annual precipitation is 16 inches, and the mean annual temperature is 51 degrees F.

Stoneham soils are near Colby, Manter, and Ascalon soils. Colby soils are silty and do not have a B2t horizon. Manter and Ascalon soils have color value of 3 or less in the surface layer when moist. Manter soils have a B2t horizon of sandy loam. Ascalon soils have a B2t horizon of sandy clay loam.

Typical pedon of Stoneham loam, in native grass about 8 miles south of Idalia, 2,600 feet east of the southwest corner of sec. 28, T. 5 S., R. 44 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; neutral; clear smooth boundary.

B2t—3 to 7 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; few very fine roots; few thin clay films lining pores and root channels; neutral; clear wavy boundary.

B3ca—7 to 14 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium prismatic structure; hard, firm, sticky and plastic; few fine roots; few fine threads of lime; violently effervescent; moderately alkaline; clear smooth boundary.

C1ca—14 to 38 inches; pink (7.5YR 7/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; slightly hard, friable, sticky and plastic; small irregular soft masses of segregated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—38 to 60 inches; pink (7.5YR 7/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; slightly hard, friable, sticky and plastic; common large irregular masses of segregated lime; violently effervescent; moderately alkaline.

The depth to calcareous material ranges from 5 to 10 inches.

The B2t horizon is clay loam or sandy clay loam. The C horizon ranges from clay loam to gravelly sandy loam.

Terry series

The Terry series consists of moderately deep, well drained soils that formed in wind-sorted calcareous material overlying highly calcareous sandstone. Terry soils are on smooth plains. Slopes range from 1 to 6 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Terry soils are similar to Iliff and Haxtun soils. They are near Haxtun, Julesburg, and Valent soils. Iliff soils are more than 35 percent clay in the B2t horizon. Haxtun soils are deep and have a buried horizon. Julesburg soils are deep. They have a B2t horizon of coarse sandy loam and a dark epipedon that is less than 20 inches thick. Valent soils are sandy and do not have a B2t horizon.

Typical pedon of Terry loamy sand, in rangeland about 20 miles south of Yuma, 792 feet west and 1,584 feet north of the southeast corner of sec. 36, T. 2 S., R. 49 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine and fine roots; neutral; clear smooth boundary.

B1t—7 to 10 inches; grayish brown (10YR 5/2) sandy loam; very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; neutral; clear smooth boundary.

B2t—10 to 21 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3ca—21 to 26 inches; light brownish gray (10YR 6/2) sandy loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, very friable, nonsticky and slightly plastic; few very fine and fine roots; violently effervescent; moderately alkaline; gradual wavy boundary.

IICr—26 inches; very pale brown (10YR 8/3) highly calcareous sandstone.

The content of organic matter in the epipedon ranges from .5 to 1 percent. The depth to sandstone ranges from 20 to 34 inches. In some pedons, the content of rock fragments is as much as 15 percent.

Valent series

The Valent series consists of deep, excessively drained soils that formed in eolian sand. Valent soils are on low sandhills. Slopes range from 1 to 45 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Valent soils are similar to Dwyer soils. They are near Dailey, Julesburg, Manter, and Vona soils. Dwyer soils have lime within a depth of 40 inches. Dailey, Manter, and Julesburg soils have a surface layer that has color value of 3 or less when moist. Julesburg, Manter, and Vona soils have a B2t horizon of sandy loam.

Typical pedon of Valent sand, 9 to 15 percent slopes, in grass about 5 miles east and 5 miles south of Yuma, 2,640 feet south of the northwest corner of sec. 22, T. 1 N., R. 47 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; neutral; clear smooth boundary.

C—4 to 60 inches; pale brown (10YR 6/3) sand, dark brown (10YR 4/3) moist; single grain; loose; few very fine and fine roots; neutral.

The A and C horizons are neutral or mildly alkaline. The C horizon ranges from sand to fine sand.

Vona series

The Vona series consists of deep, well drained soils that formed in eolian sand. Vona soils are on smooth

plains. Slopes are 0 to 3 percent. The mean annual precipitation is 17 inches, and the mean annual temperature is 51 degrees F.

Vona soils are similar to Manter soils. They are near Valent, Dwyer, and Haxtun soils. Manter and Haxtun soils have a surface layer that has color value of 3 or less when moist. Haxtun soils have a buried horizon. Valent and Dwyer soils are sandy and do not have a B horizon.

Typical pedon of Vona loamy sand, in native grass 5 miles south and 7 miles east of Abarr, 800 feet west and 175 feet north of the southeast corner of sec. 24, T. 3 S., R. 48 W.

A11—0 to 4 inches; light brownish gray (10YR 6/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, very friable; many very fine and fine roots; neutral; clear smooth boundary.

A12—4 to 18 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; mildly alkaline; clear smooth boundary.

B2t—18 to 24 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; very dark grayish brown (10YR 3/2) organic stains on one-third of the faces of peds when moist; moderate medium angular blocky structure; hard, friable, nonsticky and slightly plastic; thin continuous clay films on vertical faces of peds and thin patchy clay films on horizontal faces of peds; common very fine roots; mildly alkaline; clear wavy boundary.

B3—24 to 34 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; dark brown (10YR 4/3) organic streaks in root channels when moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, friable, nonsticky and slightly plastic; thin patchy clay films on vertical faces of peds; common very fine roots; mildly alkaline; clear wavy boundary.

C1ca—34 to 44 inches; white (10YR 8/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; very hard, friable, and slightly plastic; few very fine roots; violently effervescent; lime disseminated and in medium-sized soft masses; moderately alkaline; clear wavy boundary.

C2—44 to 60 inches; very pale brown (10YR 8/3) loamy fine sand, pale brown (10YR 6/3) moist; few medium-sized yellowish brown (10YR 5/4) mottles, moist; single grain; loose; violently effervescent; moderately alkaline.

The depth to lime ranges from 12 to 34 inches. The solum is 15 to 40 inches thick.

The C2 horizon ranges from loamy fine sand to fine sandy loam. The calcium carbonate equivalent in the Cca horizon ranges to 15 percent.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A mineral soil horizon that is characterized by the illuvial accumulation of layer-lattice silicate clays. The argillic horizon has a certain minimum thickness depending on the thickness of the solum, a minimum quantity of clay in comparison with an overlying eluvial horizon depending on the clay content of the eluvial horizon, and usually has coatings of oriented clay on the surface of pores or peds or bridging sand grains.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Local, very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Dissected slopes. An incline surface in upland topography incised by relatively shallow drainageways that are perpendicular to the main valley drainageway. Each drainageway is separated by a downward-trending ridge.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants

throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mollic epipedon. A surface horizon of mineral soil that is dark colored and relatively thick, contains at least 0.58 percent organic carbon, is not massive and hard or very hard when dry, has a base saturation of more than 50 percent when measured at pH 7, and has less than 250 ppm of phosphate soluble in 1 percent citric acid, and is dominantly saturated with bivalent cations.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For

example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plain, irregular. A plain where 50 to 80 percent of the area has slopes of less than 8 percent and where local relief is less than 300 feet within a township.

Plain, smooth. A plain where more than 80 percent of the area has slopes of less than 8 percent and where local relief is less than 200 feet within a township.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential plant community. The total plant community that is best adapted to the unique combination of environmental factors in an area. It is the plant community that is in dynamic equilibrium with the environment. Such natural disturbances as drought, wild fires, grazing of native fauna, and insects are inherent in the development of the natural potential plant community. The potential plant community is not a precise assembly of species but varies in proportions, within reasonable limits, from place to place. Generally, one species or a group of species dominates a site. Where changes in soils, topography, or moisture conditions are abrupt, plant community boundaries are distinct.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range pitting. Mechanical treatment used on rangeland to increase water infiltration rates on rangeland in poor condition. The machine makes shallow trenches 3 to 4 feet long, 4 inches deep, and 6 inches wide. These pits form miniature dams that catch water and allow it to be absorbed into the soil, which helps to increase growth of the native vegetation.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil blowing. To wear away or remove the surface layer of the soil by wind.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower

in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.1 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded at Yuma, Colorado 1951-72											
January----	43.0	14.3	28.7	68	-14	0	.43	.12	.67	1	5.1
February---	47.6	18.1	32.9	74	-10	14	.46	.07	.75	2	3.1
March------	52.9	22.5	37.7	81	-5	27	.98	.30	1.51	3	8.5
April------	65.3	33.4	49.4	87	13	104	1.35	.53	2.00	4	3.3
May--------	74.9	44.4	59.7	95	27	315	2.89	1.45	4.06	6	.4
June-------	25.5	53.7	69.6	104	37	588	2.88	1.20	4.23	6	.0
July-------	91.3	59.5	75.4	103	46	787	2.93	1.45	4.12	5	.0
August-----	89.7	57.7	73.7	102	44	735	1.64	.77	2.33	3	.0
September--	81.0	47.6	64.3	98	30	429	1.49	.35	2.38	3	.0
October----	69.4	36.6	53.0	90	17	180	1.14	.39	1.73	3	2.9
November---	52.8	23.7	38.3	77	-1	15	.66	.18	1.04	2	5.2
December---	44.2	16.4	30.3	67	-11	0	.41	.12	.63	2	4.2
Year-----	66.5	35.7	51.1	104	-20	3,194	17.26	13.78	20.53	40	34.7
Recorded at Wray, Colorado 1951-74											
January----	43.7	13.8	28.8	69	-14	0	.35	.06	.57	1	4.7
February---	48.7	18.6	33.7	76	-9	12	.38	.00	.66	1	3.8
March------	54.6	23.5	39.1	83	-4	50	.84	.26	1.30	3	6.8
April------	66.5	34.1	50.3	90	13	106	1.47	.37	2.33	3	3.1
May--------	76.5	45.2	60.9	96	28	346	2.91	1.27	6.24	6	.3
June-------	86.4	54.9	70.5	105	37	615	3.15	1.38	4.58	6	.0
July-------	91.8	60.3	76.1	104	47	809	2.78	1.24	4.03	5	.0
August-----	90.3	58.1	74.2	103	44	750	2.17	.99	3.13	4	.0
September--	81.3	47.2	64.3	99	29	429	1.41	.27	2.31	3	.0
October----	71.0	35.6	53.3	92	16	166	.92	.28	1.42	2	1.6
November---	54.6	23.6	39.1	79	1	11	.60	.17	.94	2	4.9
December---	45.5	16.2	30.9	71	-12	0	.43	.15	.65	1	4.4
Year-----	67.6	35.9	51.8	106	-19	3,294	17.41	13.47	21.11	37	29.6

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.1 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded at Bonny Lake, Colorado 1951-74											
January----	41.7	13.2	27.5	71	-13	0	.28	.06	.45	1	4.0
February---	46.0	17.5	31.8	76	-7	8	.35	.00	.59	1	4.1
March------	50.8	22.4	36.6	81	-3	24	.84	.29	1.28	3	6.9
April------	62.6	33.7	48.2	87	15	77	1.44	.46	2.21	3	2.3
May--------	73.0	44.9	59.0	95	29	291	2.79	1.42	3.90	5	.3
June-------	83.9	54.3	69.2	103	37	576	2.66	.86	4.11	6	.0
July-------	90.4	60.9	75.7	105	49	797	2.45	1.20	3.47	5	.0
August-----	89.0	59.0	74.0	103	47	744	1.93	.69	2.93	4	.0
September--	79.3	48.7	64.0	99	32	427	1.42	.29	2.31	3	.0
October----	68.7	36.7	52.8	90	19	156	.96	.27	1.51	2	2.3
November---	52.4	24.2	38.3	77	3	6	.53	.11	.85	2	3.8
December---	43.6	16.0	29.9	72	-8	0	.33	.11	.49	1	5.2
Year-----	61.1	27.9	44.5	96	-29	3,539	17.32	13.51	20.91	47	71.9

[1]A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Recorded at Yuma, Colorado 1951-72			
Last freezing temperature in spring:			
1 year in 10 later than--	May 1	May 9	May 25
2 years in 10 later than--	April 25	May 4	May 20
5 years in 10 later than--	April 14	April 26	May 11
First freezing temperature in fall:			
1 year in 10 earlier than--	October 11	October 1	September 20
2 years in 10 earlier than--	October 16	October 6	September 25
5 years in 10 earlier than--	October 25	October 14	October 4
Recorded at Wray, Colorado 1951-74			
Last freezing temperature in spring:			
1 year in 10 later than--	April 28	May 13	May 25
2 years in 10 later than--	April 24	May 9	May 20
5 years in 10 later than--	April 16	April 27	May 9
First freezing temperature in fall:			
1 year in 10 earlier than--	October 10	September 30	September 16
2 years in 10 earlier than--	October 14	October 4	September 21
5 years in 10 earlier than--	October 22	October 12	October 1

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Recorded at Bonny Lake, Colorado 1951-74			
Last freezing temperature in spring:			
1 year in 10 later than--	April 26	May 7	May 19
2 years in 10 later than--	April 21	May 2	May 14
5 years in 10 later than--	April 13	April 23	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 14	October 10	September 22
2 years in 10 earlier than--	October 19	October 14	September 27
5 years in 10 earlier than--	October 28	October 20	October 7

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
Recorded at Yuma, Colorado 1951-72			
9 years in 10	165	149	122
8 years in 10	175	157	130
5 years in 10	193	171	145
2 years in 10	211	185	160
1 year in 10	221	192	169
Recorded at Wray, Colorado 1951-74			
9 years in 10	171	140	124
8 years in 10	177	153	131
5 years in 10	188	167	144
2 years in 10	200	181	156
1 year in 10	206	188	169
Recorded at Bonny Lake, Colorado 1951-74			
9 years in 10	175	161	132
8 years in 10	183	167	140
5 years in 10	197	180	156
2 years in 10	212	192	171
1 year in 10	219	198	179

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Albinas loam	10,700	0.7
2	Ascalon loamy sand, 3 to 9 percent slopes	4,600	0.3
3	Ascalon sandy loam, 3 to 5 percent slopes	19,800	1.3
4	Ascalon sandy loam, 5 to 9 percent slopes	1,500	0.1
5	Ascalon fine sandy loam, 0 to 3 percent slopes	45,800	3.0
6	Bankard sand	10,700	0.7
7	Bayard fine sandy loam, 2 to 6 percent slopes	10,700	0.7
8	Canyon-Dioxice complex, 1 to 9 percent slopes	5,200	0.3
9	Canyon-Rock outcrop complex, 9 to 25 percent slopes	45,800	3.0
10	Colby silt loam, 3 to 6 percent slopes	44,200	2.9
11	Colby silt loam, 6 to 15 percent slopes	85,400	5.6
12	Colby-Torriorthents complex, gullied, 15 to 25 percent slopes	41,200	2.7
13	Dailey loamy sand	10,700	0.7
14	Dwyer-Vona loamy sands, 3 to 9 percent slopes	4,600	0.3
15	Eckley gravelly sandy loam, 3 to 7 percent slopes	3,000	0.2
16	Glenberg-Bankard complex	1,500	0.1
17	Haverson loam	7,600	0.5
18	Haxtun loamy sand	85,400	5.6
19	Haxtun sandy loam	71,700	4.7
20	Iliff loam	7,600	0.5
21	Inavale loamy sand	4,600	0.3
22	Julesburg loamy sand, 0 to 3 percent slopes	54,900	3.6
23	Julesburg loamy sand, 3 to 7 percent slopes	62,500	4.1
24	Kim loam, 3 to 6 percent slopes	1,500	0.1
25	Kuma-Keith silt loams	152,500	10.0
26	Laird fine sandy loam	6,100	0.4
27	Las Animas fine sandy loam	4,600	0.3
28	Las Animas loam	1,500	0.1
29	Manter loamy sand	35,100	2.3
30	Manter sandy loam, 2 to 5 percent slopes	23,400	1.5
31	Manter sandy loam, 5 to 9 percent slopes	12,600	0.8
32	Paoli sandy loam	3,000	0.2
33	Pits	300	*
34	Platner sandy loam, 3 to 5 percent slopes	3,000	0.2
35	Platner loam	45,800	3.0
36	Platte fine sandy loam	3,000	0.2
37	Rago loam	38,100	2.5
38	Rago clay loam, occasional overflow	4,600	0.3
39	Razor-Midway complex, 3 to 9 percent slopes	3,000	0.2
40	Richfield silt loam	10,700	0.7
41	Stoneham loam	1,500	0.1
42	Terry loamy sand	1,500	0.1
43	Valent sand, 1 to 9 percent slopes	259,300	17.0
44	Valent sand, 9 to 15 percent slopes	227,200	14.9
45	Valent sand, 15 to 45 percent slopes	27,500	1.8
46	Valent-Blownout land complex, 1 to 25 percent slopes	3,000	0.2
47	Vona loamy sand	13,700	0.9
	Water	2,920	0.3
	Total	1,525,120	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. All yields were estimated for a high level of management. Absence of a yield figure indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat		Corn		Grain sorghum		Alfalfa hay		Corn silage		Sugar beets	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	Ton	Ton	Ton	Ton
1: Albinas	30	55	---	125	---	---	---	6.0	---	25	---	22
2: Ascalon	20	45	20	125	25	90	---	4.0	---	18	---	18
3: Ascalon	25	55	25	135	30	100	1.5	5.0	---	20	---	20
4: Ascalon	20	45	---	120	25	90	1.5	4.0	---	18	---	---
5: Ascalon	30	65	30	145	35	110	1.5	5.0	---	26	---	22
6: Bankard	---	30	---	50	---	50	---	2.5	---	---	---	---
7: Bayard	---	50	---	110	25	80	---	4.0	---	18	---	---
10: Colby	20	45	---	120	20	80	---	4.0	---	20	---	18
13: Dailey	---	45	---	130	---	90	---	5.0	---	20	---	---
14: Dwyer	---	45	---	120	---	80	---	4.0	---	18	---	---
15: Eckley	13	---	---	---	---	---	---	---	---	---	---	---
16: Glenberg	---	50	25	110	25	90	---	4.0	---	18	---	---
17: Haverson	20	55	---	130	25	90	1.5	5.0	---	20	---	22
18: Haxtun	25	55	35	145	35	110	1.5	6.0	---	26	---	20
19: Haxtun	35	70	40	150	45	120	1.5	6.0	---	30	---	24
20: Iliff	25	55	---	110	30	90	1.5	5.0	---	20	---	---
21: Inavale	---	50	30	125	45	100	1.5	5.0	---	20	---	---
22: Julesburg	---	50	25	135	30	110	---	5.0	---	20	---	18
23: Julesburg	---	45	---	120	---	80	---	5.0	---	18	---	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat		Corn		Grain sorghum		Alfalfa hay		Corn silage		Sugar beets	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	Ton	Ton	Ton	Ton
24----------------------- Kim	20	45	---	110	---	85	1.0	4.0	---	16	---	---
25----------------------- Kuma	45	70	40	140	40	120	2.0	6.0	---	30	---	25
26----------------------- Laird	---	45	20	110	25	90	1.5	5.0	---	18	---	---
27----------------------- Las Animas	---	---	25	120	25	110	2.5	5.0	---	18	---	15
29----------------------- Manter	---	55	25	130	25	90	1.5	5.0	---	20	---	18
30----------------------- Manter	25	50	20	130	30	90	1.5	5.0	---	22	---	18
31----------------------- Manter	---	45	15	120	20	70	---	4.0	---	18	---	---
32----------------------- Paoli	25	60	30	140	25	120	1.5	5.0	---	22	---	20
34----------------------- Platner	25	55	---	125	---	100	1.5	5.0	---	22	---	20
35----------------------- Platner	40	65	---	140	---	115	1.5	5.0	---	30	---	24
37----------------------- Rago	40	70	---	145	---	120	2.0	6.0	---	30	---	24
38----------------------- Rago	35	70	---	140	---	115	2.0	6.0	---	26	---	22
39----------------------- Razor	---	---	---	110	---	90	---	4.0	---	16	---	---
40----------------------- Richfield	40	65	---	140	---	115	1.5	5.0	---	30	---	24
41----------------------- Stoneham	25	45	---	120	---	85	---	5.0	---	18	---	---
43----------------------- Valent	---	45	---	120	---	80	---	5.0	---	16	---	---
47----------------------- Vona	---	45	---	130	25	110	---	5.0	---	18	---	---

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1 Albinas	Loamy Plains	Favorable	2,200	Western wheatgrass	40
		Normal	1,800	Blue grama	30
		Unfavorable	1,400	Buffalograss	10
				Green needlegrass	5
				Sedge	5
2, 3, 4, 5 Ascalon	Sandy Plains	Favorable	2,400	Blue grama	20
		Normal	2,200	Prairie sandreed	20
		Unfavorable	2,000	Sand bluestem	10
				Needleandthread	10
				Little bluestem	5
				Switchgrass	5
				Sand dropseed	5
				Sedge	5
6 Bankard	Sandy Bottomland	Favorable	2,000	Prairie sandreed	25
		Normal	1,800	Switchgrass	20
		Unfavorable	1,700	Sand bluestem	15
				Needleandthread	10
				Blue grama	5
				Sand dropseed	5
				Little bluestem	5
				Sideoats grama	5
				Sand sagebrush	5
7 Bayard	Sandy Plains	Favorable	2,400	Prairie sandreed	20
		Normal	2,200	Blue grama	20
		Unfavorable	2,000	Needleandthread	10
				Sand bluestem	10
				Sand dropseed	5
				Little bluestem	5
				Switchgrass	5
				Sedge	5
				Sand sagebrush	5
8*:					
Canyon	Limestone Breaks	Favorable	1,250	Little bluestem	25
		Normal	1,000	Sideoats grama	15
		Unfavorable	625	Threadleaf sedge	10
				Prairie sandreed	10
				Blue grama	5
				Needleandthread	5
				Hairy grama	5
Dioxice	Loamy Plains	Favorable	2,000	Blue grama	40
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,400	Sideoats grama	10
				Buffalograss	10
				Green needlegrass	10
				Sedge	5
9*:					
Canyon	Limestone Breaks	Favorable	1,250	Little bluestem	25
		Normal	1,000	Sideoats grama	15
		Unfavorable	625	Threadleaf sedge	10
				Prairie sandreed	10
				Needleandthread	5
				Hairy grama	5
				Blue grama	5
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
10 Colby	Loamy Plains	Favorable	1,800	Blue grama	55
		Normal	1,500	Western wheatgrass	20
		Unfavorable	1,400	Buffalograss	5
				Green needlegrass	5
				Sedge	5
11 Colby	Loamy Slopes	Favorable	2,400	Western wheatgrass	25
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,800	Blue grama	20
				Little bluestem	15
				Needleandthread	10
12*:					
Colby	Loess Breaks	Favorable	1,500	Little bluestem	30
		Normal	1,200	Sideoats grama	25
		Unfavorable	800	Blue grama	15
				Western wheatgrass	10
				Sedge	5
				Prairie clover	5
Torriorthents.					
13 Dailey	Deep Sand	Favorable	3,000	Prairie sandreed	20
		Normal	2,500	Blue grama	15
		Unfavorable	2,000	Sand bluestem	15
				Sand sagebrush	10
				Switchgrass	10
				Sand dropseed	5
				Sedge	5
				Little bluestem	5
				Sideoats grama	5
14*:					
Dwyer	Deep Sand	Favorable	3,000	Prairie sandreed	20
		Normal	2,500	Blue grama	15
		Unfavorable	1,000	Sand bluestem	15
				Sand sagebrush	10
				Switchgrass	10
				Sand dropseed	5
				Sedge	5
				Little bluestem	5
				Sideoats grama	5
				Needleandthread	5
Vona	Sandy Plains	Favorable	2,400	Prairie sandreed	20
		Normal	2,200	Blue grama	20
		Unfavorable	2,000	Needleandthread	10
				Little bluestem	5
				Switchgrass	5
				Sand sagebrush	5
				Sand bluestem	5
				Sand dropseed	5
				Sedge	5
				Bush wild buckwheat	5
15 Eckley	Gravel Breaks	Favorable	1,400	Blue grama	30
		Normal	900	Little bluestem	15
		Unfavorable	600	Sideoats grama	15
				Needleandthread	10
				Sand dropseed	5
				Red threeawn	5
				Sedge	5
				Leadplant	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
16*:					
Glenberg	Sandy Bottomland	Favorable	3,000	Prairie sandreed	25
		Normal	2,500	Switchgrass	20
		Unfavorable	2,000	Sand bluestem	15
				Needleandthread	10
				Blue grama	5
				Sand dropseed	5
				Little bluestem	5
				Sideoats grama	5
				Sand sagebrush	5
Bankard	Sandy Bottomland	Favorable	2,000	Prairie sandreed	25
		Normal	1,800	Switchgrass	20
		Unfavorable	1,700	Sand bluestem	15
				Needleandthread	10
				Blue grama	5
				Sand dropseed	5
				Little bluestem	5
				Sideoats grama	5
				Sand sagebrush	5
17 Haverson	Overflow	Favorable	3,000	Western wheatgrass	40
		Normal	2,500	Blue grama	20
		Unfavorable	2,000	Green needlegrass	15
				Buffalograss	5
				Sedge	5
18 Haxtun	Sandy Plains	Favorable	2,500	Prairie sandreed	20
		Normal	2,200	Little bluestem	15
		Unfavorable	2,000	Switchgrass	10
				Blue grama	10
				Sand bluestem	8
				Sand sagebrush	5
				Needleandthread	5
19 Haxtun	Sandy Plains	Favorable	2,400	Blue grama	30
		Normal	2,100	Prairie sandreed	15
		Unfavorable	1,800	Little bluestem	5
				Switchgrass	5
				Sideoats grama	5
				Sand bluestem	5
				Sand dropseed	5
				Needleandthread	5
20 Iliff	Loamy Plains	Favorable	2,000	Blue grama	40
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,400	Buffalograss	5
				Green needlegrass	5
				Sedge	5
21 Inavale	Sandy Meadow	Favorable	4,000	Indiangrass	30
		Normal	3,500	Switchgrass	20
		Unfavorable	3,000	Sand bluestem	15
				Prairie cordgrass	10
				Sedge	10
				Little bluestem	5
				Rush	5
22, 23 Julesburg	Deep Sand	Favorable	3,000	Prairie sandreed	20
		Normal	2,500	Blue grama	15
		Unfavorable	2,000	Sand bluestem	15
				Sand sagebrush	10
				Switchgrass	10
				Needleandthread	5
				Little bluestem	5
				Sand dropseed	5
				Sideoats grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
24: Kim	Loamy Plains	Favorable	2,000	Blue grama	55
		Normal	1,800	Western wheatgrass	10
		Unfavorable	1,400	Buffalograss	5
				Sedge	5
				Green needlegrass	5
25*:					
Kuma	Loamy Plains	Favorable	2,000	Blue grama	60
		Normal	1,800	Western wheatgrass	15
		Unfavorable	1,400	Buffalograss	10
				Green needlegrass	5
				Sedge	5
Keith	Loamy Plains	Favorable	2,000	Blue grama	60
		Normal	1,800	Western wheatgrass	15
		Unfavorable	1,400	Green needlegrass	10
				Buffalograss	5
				Sedge	5
26: Laird	Sandhill Swale	Favorable	4,000	Switchgrass	25
		Normal	3,000	Indiangrass	15
		Unfavorable	2,500	Little bluestem	15
				Western wheatgrass	10
				Needleandthread	10
				Sideoats grama	5
				Inland saltgrass	5
				Sedge	5
27: Las Animas	Salt Meadow	Favorable	3,500	Alkali sacaton	40
		Normal	3,000	Switchgrass	20
		Unfavorable	2,500	Western wheatgrass	10
				Inland saltgrass	10
				Sedge	10
				Baltic rush	5
28: Las Animas	Wet Meadow	Favorable	4,000	Switchgrass	20
		Normal	3,800	Big bluestem	15
		Unfavorable	3,600	Western wheatgrass	15
				Indiangrass	10
				Sedge	10
				Rush	10
				Prairie cordgrass	5
29, 30, 31: Manter	Sandy Plains	Favorable	2,400	Prairie sandreed	20
		Normal	2,200	Blue grama	20
		Unfavorable	2,000	Needleandthread	10
				Sand bluestem	10
				Little bluestem	5
				Switchgrass	5
				Sand dropseed	5
				Sand sagebrush	5
				Sedge	5
32: Paoli	Sandy Plains	Favorable	2,400	Prairie sandreed	20
		Normal	2,200	Blue grama	20
		Unfavorable	2,000	Sand bluestem	10
				Switchgrass	5
				Little bluestem	5
				Sand dropseed	5
				Needleandthread	5
				Sedge	5
				Sand sagebrush	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
34, 35 Platner	Loamy Plains	Favorable	2,000	Blue grama	40
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,400	Sideoats grama	10
				Buffalograss	10
				Green needlegrass	10
				Sedge	5
36 Platte	Sandy Meadow	Favorable	4,000	Indiangrass	30
		Normal	3,500	Switchgrass	20
		Unfavorable	3,000	Sand bluestem	15
				Prairie cordgrass	10
				Sedge	10
				Little bluestem	5
				Rush	5
37 Rago	Loamy Plains	Favorable	2,000	Blue grama	40
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,400	Sideoats grama	10
				Buffalograss	10
				Green needlegrass	10
				Sedge	5
38 Rago	Overflow	Favorable	3,000	Western wheatgrass	40
		Normal	2,500	Blue grama	20
		Unfavorable	2,000	Green needlegrass	15
				Buffalograss	5
				Sedge	5
39*:					
Razor	Clayey Plains	Favorable	1,500	Western wheatgrass	40
		Normal	1,200	Blue grama	30
		Unfavorable	900	Buffalograss	10
				Winterfat	5
				Squirreltail	5
				Fourwing saltbush	5
Midway	Shaly Plains	Favorable	800	Blue grama	35
		Normal	700	Sideoats grama	20
		Unfavorable	500	Western wheatgrass	15
				Alkali sacaton	5
				Buffalograss	5
				Winterfat	5
				Snakeweed	5
40 Richfield	Loamy Plains	Favorable	2,000	Blue grama	40
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,400	Sideoats grama	10
				Green needlegrass	10
				Buffalograss	10
				Sedge	5
41 Stoneham	Loamy Plains	Favorable	1,800	Blue grama	55
		Normal	1,500	Western wheatgrass	20
		Unfavorable	1,200	Buffalograss	5
				Green needlegrass	5
				Sedge	5
42 Terry	Sandy Plains	Favorable	2,400	Blue grama	20
		Normal	2,200	Prairie sandreed	20
		Unfavorable	2,000	Needleandthread	10
				Sand bluestem	10
				Little bluestem	5
				Sand dropseed	5
				Sedge	5
				Switchgrass	5
				Sand sagebrush	5
				Bush wild buckwheat	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
43, 44 Valent	Deep Sand	Favorable	3,000	Prairie sandreed	20
		Normal	2,500	Sand bluestem	15
		Unfavorable	2,000	Blue grama	15
				Sand sagebrush	10
				Switchgrass	10
				Sand dropseed	5
				Needleandthread	5
				Sideoats grama	5
				Little bluestem	5
45 Valent	Choppy Sand	Favorable	1,500	Sand bluestem	30
		Normal	1,000	Prairie sandreed	25
		Unfavorable	600	Needleandthread	10
				Sand sagebrush	5
				Blue grama	5
				Sandhill muhly	5
				Indian ricegrass	5
				Blowout grass	5
46*:					
Valent	Choppy Sand	Favorable	1,500	Sand bluestem	30
		Normal	1,000	Prairie sandreed	25
		Unfavorable	600	Needleandthread	10
				Sand sagebrush	5
				Blue grama	5
				Sandhill muhly	5
				Indian ricegrass	5
				Blowout grass	5
Blownout land.					
47 Vona	Sandy Plains	Favorable	2,400	Prairie sandreed	20
		Normal	2,200	Blue grama	20
		Unfavorable	2,000	Needleandthread	10
				Little bluestem	5
				Switchgrass	5
				Sand bluestem	5
				Sand dropseed	5
				Sand sagebrush	5
				Sedge	5
				Bush wild buckwheat	2

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Expected heights of specified trees at 20 years of age								
	Ponderosa pine	Austrian pine	Rocky Mt. juniper	Russian-olive	Green ash	Honey-locust	Hackberry	Siberian elm	Eastern cotton-wood
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
1------------------ Albinas	23	25	20	16	20	24	22	36	45
2, 3, 4, 5---------- Ascalon	24	24	14	16	20	22	22	32	45
6------------------ Bankard	--	--	--	18	--	--	30	30	50
7------------------ Bayard	22	22	12	12	20	20	20	26	45
8*: Canyon.									
Dioxice------------	17	17	14	18	--	--	--	22	--
9*: Canyon.									
Rock outcrop.									
10, 11-------------- Colby	20	22	14	14	18	20	16	28	--
12*: Colby.									
Torriorthents.									
13------------------ Dailey	18	18	12	12	--	--	--	24	--
14*: Dwyer--------------	16	16	10	15	18	--	--	28	--
Vona---------------	20	20	15	18	--	25	25	30	--
15------------------ Eckley	--	--	10	10	--	--	--	15	--
16*: Glenberg-----------	22	22	14	18	20	22	20	24	50
Bankard------------	--	--	--	18	--	--	30	30	50
17------------------ Haverson	24	26	18	18	24	28	26	30	50
18, 19-------------- Haxtun	28	26	16	17	22	22	22	35	45
20------------------ Iliff	16	18	12	14	--	--	--	20	--
21------------------ Inavale	20	20	12	14	25	25	25	35	50
22, 23-------------- Julesburg	20	20	12	16	--	--	--	34	--
24------------------ Kim	18	22	16	16	18	20	18	28	--

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age								
	Ponderosa pine	Austrian pine	Rocky Mt. juniper	Russian-olive	Green ash	Honey-locust	Hackberry	Siberian elm	Eastern cotton-wood
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
25*:									
Kuma	25	25	20	16	22	24	22	36	--
Keith	25	25	20	16	22	24	22	36	--
26 Laird	22	22	12	11	20	22	20	26	45
27, 28 Las Animas	--	--	12	18	--	--	--	--	--
29, 30, 31 Manter	28	26	16	17	22	22	22	34	45
32 Paoli	28	26	16	16	22	22	22	35	50
33*. Pits									
34, 35 Platner	20	22	18	16	20	22	22	36	--
36 Platte	--	--	12	18	--	--	--	--	--
37, 38 Rago	23	25	20	16	22	24	22	36	--
39*:									
Razor.									
Midway.									
40 Richfield	22	24	20	16	22	24	22	36	--
41 Stoneham	20	20	14	14	18	20	16	30	--
42 Terry	14	14	10	12	--	--	--	20	--
43 Valent	16	16	10	15	--	--	--	24	--
44, 45. Valent									
46*:									
Valent.									
Blownout land.									
47 Vona	20	20	15	18	--	25	25	30	--

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Albinas	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
2 Ascalon	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
3 Ascalon	Slight	Slight	Moderate: slope.	Slight.
4 Ascalon	Slight	Slight	Severe: slope.	Slight.
5 Ascalon	Slight	Slight	Slight	Slight.
6 Bankard	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.	Severe: too sandy.
7 Bayard	Slight	Slight	Moderate: slope.	Slight.
8*:				
Canyon	Slight	Slight	Severe: depth to rock.	Slight.
Dioxice	Slight	Slight	Severe: slope.	Slight.
9*:				
Canyon	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
Rock outcrop.				
10 Colby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
11 Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
12*:				
Colby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
Torriorthents.				
13 Dailey	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
14*:				
Dwyer	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Vona	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, slope, dusty.	Moderate: too sandy, dusty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
15: Eckley	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
16*:				
Glenberg	Slight	Slight	Slight	Slight.
Bankard	Severe: floods.	Moderate: floods, too sandy.	Severe: floods.	Slight.
17: Haverson	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
18: Haxtun	Moderate: too sandy.	Moderate	Moderate: too sandy.	Moderate: too sandy.
19: Haxtun	Slight	Slight	Slight	Slight.
20: Iliff	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, depth to rock.	Slight.
21: Inavale	Severe: floods.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
22: Julesburg	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
23: Julesburg	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
24: Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
25*:				
Kuma	Slight	Slight	Slight	Slight.
Keith	Slight	Slight	Slight	Slight.
26: Laird	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
27, 28: Las Animas	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
29: Manter	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
30: Manter	Slight	Slight	Moderate: slope.	Slight.
31: Manter	Slight	Slight	Severe: slope.	Slight.
32: Paoli	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
33*. Pits				
34: Platner	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
35------ Platner	Moderate: percs slowly.	Slight------	Moderate: percs slowly.	Slight.
36------ Platte	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
37------ Rago	Moderate: percs slowly.	Slight------	Moderate: percs slowly.	Slight.
38------ Rago	Severe: floods.	Moderate: floods.	Moderate: floods, too clayey, percs slowly.	Moderate: too clayey.
39*:				
Razor------	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
Midway------	Severe: percs slowly.	Moderate: too clayey.	Severe: slope, depth to rock.	Moderate: too clayey, slope.
40------ Richfield	Moderate: percs slowly.	Slight------	Moderate: percs slowly.	Slight.
41------ Stoneham	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
42------ Terry	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, slope, depth to rock.	Moderate: too sandy, dusty.
43------ Valent	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Severe: too sandy.	Severe: too sandy.
44------ Valent	Moderate: too sandy, slope, dusty.	Moderate: too sandy, slope, dusty.	Severe: too sandy, slope.	Severe: too sandy.
45------ Valent	Severe: slope.	Severe: slope.	Severe: too sandy, slope.	Severe: too sandy, slope.
46*:				
Valent------	Moderate: too sandy, slope, dusty.	Moderate: too sandy, slope, dusty.	Severe: too sandy, slope.	Severe: too sandy.
Blownout land.				
47------ Vona	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.	Moderate: too sandy, dusty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1----------------- Albinas	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Poor.
2----------------- Ascalon	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
3----------------- Ascalon	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
4----------------- Ascalon	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
5----------------- Ascalon	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
6----------------- Bankard	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
7----------------- Bayard	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
8*:									
Canyon------------	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Dioxice-----------	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Fair.
9*:									
Canyon------------	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Rock outcrop.									
10---------------- Colby	Fair	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
11---------------- Colby	Poor	Fair	Fair	Poor	Poor	Very poor	Poor	Very poor	Poor.
12*:									
Colby-------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Torriorthents.									
13---------------- Dailey	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
14*:									
Dwyer-------------	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Vona--------------	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
15---------------- Eckley	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
16*:									
Glenberg----------	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Bankard-----------	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
17---------------- Haverson	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
18----------------- Haxtun	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
19----------------- Haxtun	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
20----------------- Iliff	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Fair.
21----------------- Inavale	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
22----------------- Julesburg	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
23----------------- Julesburg	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
24----------------- Kim	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
25*:									
Kuma---------------	Good	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Keith--------------	Good	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
26----------------- Laird	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
27, 28------------- Las Animas	Poor	Poor	Good	Fair	Good	Good	Poor	Good	Fair.
29, 30------------- Manter	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
31----------------- Manter	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
32----------------- Paoli	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
33*. Pits									
34----------------- Platner	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
35----------------- Platner	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
36----------------- Platte	Fair	Good	Fair	Good	Fair	Good	Fair	Good	Fair.
37----------------- Rago	Good	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
38----------------- Rago	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
39*:									
Razor--------------	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Midway-------------	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
40----------------- Richfield	Good	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
41----------------- Stoneham	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
42----------------- Terry	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
43----------------- Valent	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
44----------------- Valent	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
45----------------- Valent	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
46*:									
Valent------------	Very poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Blownout land.									
47----------------- Vona	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1----------------- Albinas	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods, shrink-swell.
2, 3, 4----------- Ascalon	Slight-----------	Moderate: low strength.	Moderate: low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Moderate: frost action, low strength, shrink-swell.
5----------------- Ascalon	Slight-----------	Moderate: low strength.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: frost action, low strength, shrink-swell.
6----------------- Bankard	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
7----------------- Bayard	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Slight.
8*:					
Canyon-----------	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate. depth to rock.
Dioxice----------	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell, slope.	Severe: low strength.
9*:					
Canyon-----------	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
Rock outcrop.					
10---------------- Colby	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.
11---------------- Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
12*:					
Colby------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Torriorthents.					
13---------------- Dailey	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
14*:					
Dwyer------------	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.
Vona-------------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.
15---------------- Eckley	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
16*:					
Glenberg	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Bankard	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
17 Haverson	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
18, 19 Haxtun	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, frost action.
20 Iliff	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
21 Inavale	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
22 Julesburg	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.
23 Julesburg	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength, frost action.
24 Kim	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.
25*:					
Kuma	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.
Keith	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
26 Laird	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
27, 28 Las Animas	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.
29, 30 Manter	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.	Moderate: low strength, frost action.
31 Manter	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength, frost action.	Moderate: low strength, frost action.
32 Paoli	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, frost action, floods.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
33*. Pits					
34 Platner	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
35 Platner	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
36 Platte	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
37 Rago	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, frost action, low strength.
38 Rago	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
39*: Razor	Moderate: depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Midway	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
40 Richfield	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
41 Stoneham	Slight	Slight	Slight	Slight	Moderate: low strength.
42 Terry	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
43 Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
44 Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
45 Valent	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
46*: Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Blownout land.					
47 Vona	Slight	Slight	Slight	Slight	Moderate: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1------------------- Albinas	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
2, 3---------------- Ascalon	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
4------------------- Ascalon	Slight-----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
5------------------- Ascalon	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
6------------------- Bankard	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
7------------------- Bayard	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
8*:					
Canyon--------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: thin layer, area reclaim.
Dioxice------------	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Fair: too clayey.
9*:					
Canyon--------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Rock outcrop.					
10------------------ Colby	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
11------------------ Colby	Moderate: slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope.
12*:					
Colby---------------	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Torriorthents.					
13------------------ Dailey	Slight-----------	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Fair: too sandy.
14*:					
Dwyer---------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy.
Vona----------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
15------------------ Eckley	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
16*:					
Glenberg	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Bankard	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
17 Haverson	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
18 Haxtun	Slight	Moderate: seepage, excess humus.	Moderate: too sandy.	Slight	Fair: too sandy.
19 Haxtun	Slight	Moderate: seepage, excess humus.	Slight	Slight	Good.
20 Iliff	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
21 Inavale	Moderate: floods.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
22, 23 Julesburg	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
24 Kim	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
25*:					
Kuma	Moderate: percs slowly.	Moderate: seepage, excess humus.	Slight	Slight	Good.
Keith	Slight	Moderate: seepage.	Slight	Slight	Good.
26 Laird	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
27, 28 Las Animas	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness.
29, 30 Manter	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
31 Manter	Slight	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Good.
32 Paoli	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: seepage, floods.	Good.
33*. Pits					
34 Platner	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35 Platner	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
36 Platte	Severe: floods, wetness.	Severe: seepage, wetness, floods.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness, area reclaim.
37 Rago	Severe: percs slowly.	Moderate: excess humus.	Moderate: too clayey.	Slight	Fair: too clayey.
38 Rago	Severe: percs slowly, floods.	Moderate: excess humus.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
39*:					
Razor	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey, thin layer, area reclaim.
Midway	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey, thin layer, area reclaim.
40 Richfield	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
41 Stoneham	Slight	Moderate: seepage.	Slight	Slight	Good.
42 Terry	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: thin layer, area reclaim.
43 Valent	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
44 Valent	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
45 Valent	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, slope, seepage.	Severe: slope, seepage.	Poor: too sandy, slope.
46*:					
Valent	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
Blownout land.					
47 Vona	Slight	Severe: seepage.	Slight	Slight	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1 Albinas	Fair: low strength.	Unsuited	Unsuited	Fair: too clayey.
2 Ascalon	Fair: low strength, frost action.	Unsuited	Unsuited	Poor: too sandy.
3, 4, 5 Ascalon	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
6 Bankard	Fair: low strength.	Fair: excess fines.	Unsuited	Poor: too sandy.
7 Bayard	Good	Poor: excess fines.	Unsuited	Good.
8*:				
Canyon	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: area reclaim.
Dioxice	Poor: low strength.	Unsuited	Unsuited.	
9*:				
Canyon	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: area reclaim.
Rock outcrop.				
10 Colby	Fair: low strength.	Unsuited	Unsuited	Good.
11 Colby	Fair: low strength.	Unsuited	Unsuited	Fair: slope.
12*:				
Colby	Fair: low strength.	Unsuited	Unsuited	Poor: slope.
Torriorthents.				
13 Dailey	Fair: low strength.	Fair: excess fines.	Unsuited	Poor: too sandy.
14*:				
Dwyer	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
Vona	Fair: low strength.	Poor: excess fines.	Unsuited	Good.
15 Eckley	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
16*:				
Glenberg	Fair: low strength.	Poor: excess fines.	Unsuited	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16*:				
Bankard	Fair: low strength.	Fair: excess fines.	Unsuited	Poor: too sandy.
17 Haverson	Fair: low strength.	Unsuited	Unsuited	Good.
18, 19 Haxtun	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
20 Iliff	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
21 Inavale	Good	Fair: excess fines.	Unsuited	Fair: too sandy.
22, 23 Julesburg	Fair: low strength, frost action.	Poor: excess fines.	Unsuited	Fair: too sandy.
24 Kim	Fair: low strength.	Unsuited	Unsuited	Good.
25*:				
Kuma	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
Keith	Fair: shrink-swell.	Unsuited	Unsuited	Good.
26 Laird	Fair: low strength, frost action.	Poor: excess fines.	Unsuited	Good.
27 Las Animas	Poor: wetness, frost action.	Poor: excess fines.	Unsuited	Fair: excess salt.
28 Las Animas	Poor: wetness, frost action.	Poor: excess fines.	Unsuited	Good.
29 Manter	Fair: low strength, frost action.	Poor: excess fines.	Unsuited	Fair: too sandy.
30, 31 Manter	Fair: low strength, frost action.	Poor: excess fines.	Unsuited	Good.
32 Paoli	Fair: low strength, frost action.	Fair: excess fines.	Unsuited	Good.
33*. Pits				
34, 35 Platner	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
36: Platte	Poor: wetness, area reclaim.	Good	Fair: excess fines.	Poor: wetness, area reclaim.
37: Rago	Fair: shrink-swell, low strength, frost action.	Unsuited	Unsuited	Fair: thin layer.
38: Rago	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
39*:				
Razor	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Fair: too clayey.
Midway	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: area reclaim.
40: Richfield	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
41: Stoneham	Fair: low strength.	Unsuited	Unsuited	Good.
42: Terry	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Fair: small stones.
43, 44: Valent	Good	Fair: excess fines.	Unsuited	Poor: too sandy.
45: Valent	Poor: slope.	Fair: excess fines.	Unsuited	Poor: too sandy, slope.
46*:				
Valent	Good	Fair: excess fines.	Unsuited	Poor: too sandy.
Blownout land.				
47: Vona	Fair: low strength.	Poor: excess fines.	Unsuited	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1----------------- Albinas	Seepage--------	Low strength, piping.	Floods---------	Floods---------	Piping---------	Favorable.
2----------------- Ascalon	Slope, seepage.	Piping, low strength.	Slope----------	Slope, erodes easily.	Erodes easily, piping, slope.	Erodes easily, slope.
3----------------- Ascalon	Slope, seepage.	Piping, low strength.	Slope----------	Slope, erodes easily.	Erodes easily, piping, slope.	Erodes easily, slope.
4----------------- Ascalon	Slope, seepage.	Piping, low strength.	Slope----------	Slope, erodes easily.	Erodes easily, piping, slope.	Erodes easily, slope.
5----------------- Ascalon	Seepage--------	Piping, low strength.	Slope----------	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
6----------------- Bankard	Seepage--------	Piping, seepage, erodes easily.	Cutbanks cave, floods, poor outlets.	Droughty, floods, seepage.	Erodes easily, piping.	Droughty, erodes easily.
7----------------- Bayard	Seepage, slope.	Seepage, piping, erodes easily.	Not needed-----	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
8*:						
Canyon-----------	Depth to rock, slope.	Thin layer-----	Not needed-----	Rooting depth, slope.	Depth to rock, slope.	Droughty, slope.
Dioxice----------	Slope----------	Low strength, piping.	Percs slowly---	Erodes easily, excess lime, soil blowing.	Erodes easily, slope.	Erodes easily, slope.
9*:						
Canyon-----------	Depth to rock, slope.	Thin layer-----	Not needed-----	Rooting depth, slope.	Depth to rock, slope.	Droughty, slope.
Rock outcrop.						
10---------------- Colby	Seepage--------	Low strength, piping.	Not needed-----	Slope, erodes easily.	Favorable------	Slope, erodes easily.
11---------------- Colby	Seepage, slope.	Low strength, piping.	Not needed-----	Slope, erodes easily.	Slope----------	Slope, erodes easily.
12*:						
Colby------------	Seepage, slope.	Low strength, piping.	Not needed-----	Slope, erodes easily.	Slope----------	Slope, erodes easily.
Torriorthents.						
13---------------- Dailey	Seepage, slope.	Piping, seepage, erodes easily.	Slope----------	Complex slope, soil blowing, droughty.	Complex slope, too sandy, erodes easily.	Erodes easily, droughty, slope.
14*:						
Dwyer------------	Slope, seepage.	Seepage, piping.	Slope, cutbanks cave.	Slope, droughty, erodes easily.	Piping, erodes easily, soil blowing.	Droughty, erodes easily, soil blowing.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
14*:						
Vona	Seepage, slope.	Piping, erodes easily, seepage.	Slope	Slope, fast intake, seepage.	Piping, erodes easily.	Erodes easily.
15 Eckley	Seepage, slope.	Seepage, piping.	Slope	Droughty, slope.	Favorable	Droughty.
16*:						
Glenberg	Seepage	Piping, erodes easily.	Slope	Slope	Floods, piping.	Favorable.
Bankard	Seepage	Piping, seepage, erodes easily.	Cutbanks cave, floods, poor outlets.	Droughty, floods, seepage.	Erodes easily, piping.	Droughty, erodes easily.
17 Haverson	Seepage	Low strength, compressible, piping.	Slope	Slope	Floods, piping.	Favorable.
18, 19 Haxtun	Slope, seepage.	Low strength, piping.	Slope	Slope, erodes easily.	Erodes easily	Erodes easily.
20 Iliff	Depth to rock	Thin layer, low strength, piping.	Percs slowly, depth to rock, slope.	Percs slowly, slope.	Percs slowly, slope.	Slope.
21 Inavale	Seepage	Seepage, piping.	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
22 Julesburg	Seepage	Seepage, piping, low strength.	Slope	Droughty, soil blowing, erodes easily.	Soil blowing, piping.	Erodes easily.
23 Julesburg	Seepage, slope.	Seepage, piping, low strength.	Slope	Droughty, slope, soil blowing.	Soil blowing, piping.	Erodes easily.
24 Kim	Seepage, slope.	Piping, low strength, hard to pack.	Slope	Slope	Slope, piping.	Slope.
25*:						
Kuma	Seepage	Low strength, compressible, piping.	Slope	Slope	Favorable	Favorable.
Keith	Seepage	Piping, erodes easily.	Not needed	Slope	Erodes easily, slope.	Erodes easily, slope.
26 Laird	Seepage	Piping, low strength.	Excess sodium	Excess lime, soil blowing, excess sodium.	Piping	Excess sodium.
27, 28 Las Animas	Seepage	Piping, seepage.	Poor outlets, wetness.	Floods, wetness.	Wetness, piping.	Wetness.
29 Manter	Seepage	Piping, low strength.	Slope	Droughty, soil blowing, slope.	Soil blowing, piping.	Erodes easily.
30, 31 Manter	Seepage	Piping, low strength.	Slope	Droughty, slope, erodes easily.	Soil blowing, piping.	Erodes easily.
32 Paoli	Seepage	Piping, low strength.	Slope	Slope	Piping	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
33*. Pits						
34, 35 Platner	Slope	Low strength, erodes easily, piping.	Slope, percs slowly.	Slope, percs slowly.	Complex slope, percs slowly.	Percs slowly, slope.
36 Platte	Seepage	Seepage	Floods, wetness.	Seepage, floods.	Not needed	Not needed.
37 Rago	Favorable	Compressible, low strength, piping.	Slope, percs slowly.	Slope, percs slowly.	Favorable	Favorable.
38 Rago	Favorable	Low strength, compressible, piping.	Floods, percs slowly.	Floods, slow intake, percs slowly.	Percs slowly	Favorable.
39*: Razor	Slope, depth to rock, seepage.	Thin layer, shrink-swell, low strength.	Slope, depth to rock, percs slowly.	Slope, rooting depth, seepage.	Percs slowly, rooting depth, depth to rock.	Slope, rooting depth, percs slowly.
Midway	Slope, depth to rock, seepage.	Thin layer, shrink-swell, low strength.	Complex slope, depth to rock, excess salt.	Complex slope, rooting depth, excess salt.	Rooting depth, depth to rock, poor outlets.	Slope, percs slowly, excess salt.
40 Richfield	Favorable	Shrink-swell, low strength.	Favorable	Slow intake, slope.	Percs slowly	Percs slowly.
41 Stoneham	Seepage, slope.	Low strength, compressible, piping.	Slope	Slope	Favorable	Favorable.
42 Terry	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, rooting depth.	Slope, rooting depth, soil blowing.	Depth to rock, piping, soil blowing.	Rooting depth, soil blowing.
43 Valent	Seepage, slope.	Piping, seepage.	Slope	Slope, erodes easily, droughty.	Erodes easily, piping.	Erodes easily.
44, 45 Valent	Seepage, slope.	Piping, seepage.	Slope	Slope, erodes easily, droughty.	Slope, erodes easily, piping.	Slope, erodes easily.
46* Valent	Seepage, slope.	Piping, seepage.	Slope	Slope, erodes easily, droughty.	Slope, erodes easily, piping.	Slope, erodes easily.
Blownout land.						
47 Vona	Seepage, slope.	Piping, erodes easily, seepage.	Slope	Slope, fast intake, seepage.	Piping, erodes easily.	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol > means more than. Absence of an entry indicates that data were not established]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1-------------------Albinas	0-6	Loam-------------	ML	A-4	0	100	85-100	80-100	50-75	20-30	NP-5
	6-31	Sandy clay loam, clay loam.	SC, CL	A-6	0	100	85-100	80-100	40-80	30-40	10-20
	31-60	Loam, fine sandy loam.	CL-ML, ML SM	A-4	0	100	85-100	60-95	40-75	20-35	5-10
2-------------------Ascalon	0-8	Loamy sand-------	SM	A-2	0	85-100	80-100	50-90	15-25	---	NP
	8-29	Sandy clay loam	SC, CL	A-6	0	85-100	80-100	75-100	40-55	20-40	10-20
	29-60	Sandy loam, fine sandy loam.	SC, SM-SC	A-4, A-2	0	85-100	80-100	70-95	35-50	15-25	NP-10
3, 4----------------Ascalon	0-6	Sandy loam-------	SM, SM-SC	A-2	0	85-100	80-100	70-95	25-35	15-25	NP-5
	6-18	Sandy clay loam	SC, CL	A-6	0	85-100	80-100	75-100	40-55	20-40	10-20
	18-60	Sandy loam, fine sandy loam, fine sand.	SM-SC	A-4, A-2	0	85-100	80-100	70-95	20-50	15-25	NP-10
5-------------------Ascalon	0-6	Fine sandy loam	SM, SM-SC	A-2	0	85-100	80-100	70-95	25-35	15-25	NP-5
	6-18	Sandy clay loam	SC, CL	A-6	0	85-100	80-100	75-100	40-55	20-40	10-20
	18-60	Sandy loam, fine sandy loam, loamy fine sand	SM-SC	A-4, A-2	0	85-100	80-100	70-95	20-50	15-25	NP-10
6-------------------Bankard	0-5	Sand-------------	SP-SM, SM	A-2, A-3	0	95-100	80-100	50-75	5-25	---	NP
	5-60	Sand, gravelly sand.	SP-SM, SM	A-2, A-3, A-1	0-5	70-100	60-100	40-70	5-25	---	NP
7-------------------Bayard	0-36	Fine sandy loam	SM, ML	A-4, A-2	0	90-100	80-100	60-85	30-60	---	NP
	36-60	Loamy fine sand	SM, SM-SC	A-2	0	85-100	80-100	50-80	15-35	---	NP
8*:											
Canyon-------------	0-12	Loam-------------	CL-ML, CL	A-4, A-6	0-5	75-100	65-100	45-95	50-75	15-30	5-15
	12	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Dioxice------------	0-9	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	65-95	35-55	15-25	NP-5
	9-24	Loam, sandy clay loam.	ML, CL, SC	A-4, A-6	0	85-100	80-100	75-100	40-75	30-45	5-20
	24-60	Loam, sandy clay loam.	ML, CL	A-4, A-6,	0-15	85-100	80-100	75-100	50-85	30-45	5-20
9*:											
Canyon-------------	0-12	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	75-100	45-95	50-75	15-30	5-15
	12	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
10, 11--------------Colby	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
	8-60	Silt loam, loam	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
12*:											
Colby--------------	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
	8-60	Silt loam, loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
Torriorthents.											
13------------------Dailey	0-12	Loamy sand-------	SM, SP-SM	A-2, A-3	0	100	100	80-95	10-30	---	NP
	12-60	Loamy sand, fine sand, sand.	SP-SM, SM, SP	A-2, A-3	0	100	95-100	75-95	2-25	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
14*:											
Dwyer-------------	0-12	Loamy sand------	SM	A-2	0	100	100	65-80	20-35	---	NP
	12-60	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2	0	85-100	75-100	50-80	5-35	---	NP
Vona--------------	0-18	Loamy fine sand	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	18-34	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
	34-60	Very fine sandy loam, loamy fine sand.	SM	A-2	0	100	90-100	50-85	15-30	---	NP
15---------------- Eckley	0-5	Gravelly sandy loam.	SM	A-2	0	70-90	50-85	20-55	15-30	20-40	NP-10
	5-15	Gravelly sandy clay loam, gravelly loam.	SC	A-2, A-6	0	75-95	50-75	30-65	20-45	25-40	10-20
	15-60	Gravelly sand, gravelly loamy sand.	SM, SP-SM, GP-GM, GM	A-1	0	45-70	35-60	15-45	5-15	---	NP
16*:											
Glenberg----------	0-8	Fine sandy loam	SM	A-4, A-2	0	95-100	85-100	60-100	30-45	---	NP
	8-60	Stratified sand to sandy clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	---	NP
Bankard-----------	0-19	Sandy loam------	SM	A-2, A-4	0	95-100	90-100	60-70	30-40	15-25	NP
	19-60	Fine sand, sand, gravelly sand.	SP-SM, SM	A-2, A-3, A-1	0-5	70-100	60-100	40-70	5-25	---	NP
17---------------- Haverson	0-14	Loam------------	ML	A-4	0	95-100	80-100	75-90	50-60	20-35	NP-10
	14-60	Stratified silty clay loam to fine sandy loam	ML	A-4	0	95-100	75-100	75-90	50-60	20-35	NP-10
18---------------- Haxtun	0-10	Loamy sand------	SM	A-2	0	95-100	80-100	50-75	15-30	---	NP
	10-20	Sandy loam, sandy clay loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	15-30	NP-10
	20-41	Clay loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-90	50-80	20-35	5-15
	41-60	Loam, gravelly loam, sandy loam.	ML, SM, CL-ML, CL	A-2, A-4	0	75-100	60-100	55-85	30-70	10-30	NP-10
19---------------- Haxtun	0-7	Sandy loam------	SM	A-2, A-4	0	95-100	80-100	60-75	25-40	---	NP
	7-20	Sandy loam, sandy clay loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	15-30	NP-10
	20-33	Clay loam, loam	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-90	60-80	20-35	5-15
	33-60	Clay loam, gravelly loam, sandy loam.	ML, SM, CL-ML, CL	A-2, A-4	0	75-100	60-100	55-85	30-70	10-30	NP-10
20---------------- Iliff	0-6	Loam------------	ML, CL-ML, CL	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	6-18	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	15-30
	18-26	Silt loam, loam, clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-85	20-35	5-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
21----------------- Inavale	0-16	Loamy sand------	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	---	NP
	16-52	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
	52-60	Sandy clay loam	CL, CL-ML	A-4, A-6	0	100	100	70-90	50-75	25-35	5-20
22----------------- Julesburg	0-11	Loamy sand------	SM	A-2, A-4	0	95-100	75-100	50-75	15-25	---	NP
	11-34	Fine sandy loam, sandy loam.	SM, ML	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	34-60	Sandy loam, loamy sand, fine sand.	SM	A-2, A-4	0	95-100	75-100	40-85	15-50	---	NP
23----------------- Julesburg	0-11	Loamy sand------	SM	A-2, A-4	0	95-100	75-100	50-75	15-25	---	NP
	11-19	Coarse sandy loam, sandy loam.	SM, ML	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	19-60	Loamy sand, sand	SM	A-2, A-4 A-1	0	95-100	75-100	40-85	5-15	---	NP
24----------------- Kim	0-16	Loam------------	ML, SM	A-4	0-5	80-100	75-100	60-90	45-75	20-35	NP-5
	16-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	80-100	75-100	70-95	60-85	25-40	5-15
25*:											
Kuma---------------	0-10	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	25-40	5-15
	10-30	Silty clay loam, silt loam, loam.	CL	A-6, A-4	0	100	95-100	90-100	85-95	30-40	10-15
	30-60	Silt loam, loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	85-95	25-40	5-15
Keith--------------	0-4	Silt loam-------	CL-ML	A-4	0	100	100	95-100	85-95	20-35	5-10
	4-15	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
	15-60	Silt loam, very fine sandy loam	CL-ML	A-4	0	100	100	95-100	85-95	20-35	5-10
26----------------- Laird	0-27	Fine sandy loam	SM	A4, A-2	0	100	95-100	70-80	25-50	15-25	NP-5
	27-46	Very fine sandy loam, fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4	0	100	90-100	80-90	40-65	15-30	NP-10
	46-60	Loamy fine sand, sand.	SM	A-2, A-1, A-4	0	75-100	75-100	45-75	10-40	---	NP
27----------------- Las Animas	0-7	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	50-75	20-50	---	NP
	7-60	Stratified sand to very fine sandy loam.	SM	A-2, A-4	0	90-100	75-100	50-70	25-40	---	NP
28----------------- Las Animas	0-7	Loam------------	SM, ML	A-4	0	95-100	90-100	70-80	40-65	---	NP
	7-60	Stratified sandy loam to sandy clay loam.	SM-SC, SM	A-2, A-4	0	90-100	75-100	50-70	25-40	20-30	5-15
29----------------- Manter	0-6	Loamy sand------	SM	A-2, A-4	0	95-100	75-100	45-85	15-45	---	NP
	6-21	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	21-60	Fine sandy loam, loamy sand.	SM	A-2, A-4	0	95-100	75-100	40-85	15-50	---	NP
30, 31------------- Manter	0-6	Sandy loam------	SM, ML	A-2, A-4	0	95-100	75-100	45-85	25-55	---	NP
	6-28	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	28-60	Sandy loam, loamy sand.	SM	A-2, A-4	0	95-100	75-100	40-85	15-50	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
32----------------- Paoli	0-5	Sandy loam------	SM, ML	A-4	0	90-100	80-100	70-85	40-60	---	NP
	5-32	Fine sandy loam, sandy loam.	SM	A-4	0	80-100	80-100	60-85	35-50	---	NP
	32-60	Fine sandy loam, sandy loam, coarse sandy loam.	SM	A-2, A-4	0	75-100	75-100	55-85	30-50	---	NP
33*. Pits											
34----------------- Platner	0-6	Sandy loam------	SM, ML	A-4	0	90-100	75-100	65-95	35-55	20-35	NP-5
	6-16	Clay, clay loam	CL, CH	A-7, A-6	0	90-100	85-100	80-100	60-95	35-60	15-30
	16-36	Loam, clay loam	CL	A-6	0	90-100	75-100	70-95	60-80	30-40	10-20
	36-60	Gravelly sandy loam, sandy loam, loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	0	75-100	60-95	55-70	30-60	20-40	5-20
35----------------- Platner	0-6	Loam------------	ML	A-4	0	90-100	85-100	65-95	50-70	20-35	NP-5
	6-16	Clay, clay loam	CL, CH	A-7, A-6	0	90-100	85-100	80-100	60-95	35-60	15-30
	16-36	Loam, sandy clay loam.	CL	A-6	0	90-100	75-100	70-95	60-80	30-40	10-20
	36-60	Gravelly sandy loam, gravelly sandy clay loam gravelly sand.	SM-SC, SC, CL-ML, CL	A-2, A-1 A-4, A-6	0	75-100	60-95	30-70	50-60	20-40	NP-20
36----------------- Platte	0-6	Fine sandy loam	CL-ML, ML, SM, SM-SC	A-4	0	100	95-100	70-85	40-55	20-35	3-10
	6-13	Very fine sandy loam, loam, fine sand.	ML, CL-ML SM	A-4	0	100	95-100	85-95	35-65	---	NP-5
	13-60	Gravelly coarse sand.	SP-SM, SM	A-1	0	70-90	50-75	30-50	5-15	---	NP
37----------------- Rago	0-8	Loam------------	ML	A-4	0	100	95-100	90-100	55-95	20-40	NP-10
	8-29	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	30-50	10-20
	29-60	Silt loam, loam, fine sandy loam	ML, SM	A-4	0	95-100	90-100	80-100	35-95	20-30	NP-5
38----------------- Rago	0-10	Clay loam-------	CL	A-6	0	95-100	95-100	90-100	60-95	30-35	10-15
	10-32	Clay loam, silty clay loam, clay.	CL	A-6, A-7	0	95-100	95-100	90-100	60-95	30-50	10-30
	32-60	Silt loam, clay loam, sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2	0	75-100	75-100	55-100	30-95	15-35	NP-10
39*: Razor-------------	0-4	Clay loam-------	CL	A-6	0	100	100	90-100	75-85	30-40	15-25
	4-28	Clay loam, clay	CL	A-6, A-7	0	100	100	90-100	75-85	35-45	25-30
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Midway------------	0-13	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-95	45-60	20-35
	13	Weathered bedrock.	---	---	---	---	---	---	---	---	---
40----------------- Richfield	0-3	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	25-35	5-15
	3-19	Silty clay loam, clay loam.	CL, CH	A-7-6	0	100	100	95-100	90-100	40-60	20-35
	19-60	Silty clay loam, silt loam.	CL-ML, CL	A-4, A-6, A-7-6	0	100	100	95-100	85-100	30-45	5-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
41------------------ Stoneham	0-3	Loam------------	ML, CL-ML	A-4	0	90-100	75-100	65-95	60-75	20-30	5-10
	3-7	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	90-100	80-100	35-80	25-40	5-25
	7-60	Loam, gravelly sandy loam, sandy clay loam	CL, SC, SM-SC, CL-ML	A-4, A-6, A-2	0	70-100	50-100	45-95	25-75	15-30	5-15
42------------------ Terry	0-7	Loamy sand------	SM	A-2	0-5	75-100	75-100	60-85	25-35	---	NP
	7-21	Fine sandy loam, sandy loam.	SM, ML	A-4	0	75-100	75-100	70-85	40-60	---	NP
	21-26	Fine sandy loam, sandy loam, loamy fine sand.	SM	A-2, A-4	0-5	75-100	75-100	70-85	25-50	---	NP
	26	Weathered bedrock.	---	---	---	---	---	---	---	---	---
43, 44, 45---------- Valent	0-4	Sand------------	SP-SM, SM	A-2, A-3	0	100	100	70-90	5-20	---	NP
	4-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	95-100	75-90	5-20	---	NP
46*:											
Valent-------------	0-4	Sand------------	SP-SM, SM	A-2, A-3	0	100	100	70-90	5-20	---	NP
	4-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	95-100	75-90	5-20	---	NP
Blownout land.											
47------------------ Vona	0-18	Loamy sand------	SM	A-2	0	100	90-100	60-90	15-30	---	NP
	18-44	Fine sandy loam, sandy loam, very fine sandy loam.	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
	44-60	Sandy loam, loamy fine sand	SM	A-2	0	100	90-100	50-85	15-30	---	NP

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factor--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
1	0-6	0.6-2.0	0.15-0.20	6.6-7.8	<2	Low	High	Low	0.32	5	6
Albinas	6-31	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	High	Low	0.28		
	31-60	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low	High	Moderate	0.43		
2	0-8	6.0-20	0.06-0.13	6.6-7.8	<2	Low	Low	Low	0.15	5	2
Ascalon	8-29	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	Low	Low	0.24		
	29-60	0.6-2.0	0.11-0.15	7.9-9.0	<2	Low	Moderate	Moderate	0.24		
3, 4, 5	0-6	0.6-2.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.17	5	3
Ascalon	6-18	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	Low	Low	0.24		
	18-60	0.6-2.0	0.11-0.15	7.9-8.4	<2	Low	Moderate	Moderate	0.24		
6	0-5	>20	0.05-0.08	7.4-8.4	<2	Low	Moderate	Moderate	0.10	5	2
Bankard	5-60	>20	0.05-0.08	7.4-8.4	<2	Low	Moderate	Moderate	0.10		
7	0-36	2.0-6.0	0.13-0.15	6.6-8.4	<2	Low	Moderate	Moderate	0.20	5	3
Bayard	36-60	2.0-6.0	0.08-0.13	7.9-8.4	<2	Low	Moderate	Moderate	0.17		
8*:											
Canyon	0-12	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	Low	Moderate	0.32	2	4L
	12	---	---	---	---	---	---	---	---		
Dioxice	0-9	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	Moderate	Moderate	0.32	3	3
	9-24	0.6-2.0	0.16-0.21	7.4-8.4	<2	Moderate	Moderate	Moderate	0.37		
	24-60	0.2-0.6	0.13-0.16	7.9-8.4	<2	Moderate	Moderate	Moderate	0.37		
9*:											
Canyon	0-12	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	Low	Moderate	0.32	2	4L
	12	---	---	---	---	---	---	---	---		
Rock outcrop.											
10, 11	0-8	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	Low	Moderate	0.37	5	4L
Colby	8-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	Low	Moderate	0.37		
12*:											
Colby	0-8	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	Low	Moderate	0.37	5	4L
	8-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	Low	Moderate	0.37		
Torriorthents.											
13	0-12	6.0-20	0.05-0.12	6.6-7.3	<2	Low	Low	Low	0.15	5	2
Dailey	12-60	6.0-20	0.03-0.10	6.6-7.8	<2	Low	Low	Low	0.15		
14*:											
Dwyer	0-12	6.0-20	0.07-0.10	7.4-8.4	<2	Low	Low	Low	0.32	5	2
	12-60	6.0-20	0.04-0.10	7.9-8.4	<2	Low	Low	Moderate	0.32		
Vona	0-18	6.0-20	0.09-0.11	6.6-7.3	<2	Low	Low	Low	0.10	5	2
	18-34	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	High	Low	0.10		
	34-60	2.0-6.0	0.08-0.11	7.4-8.4	<4	Low	High	Moderate	0.10		
15	0-5	0.6-6.0	0.09-0.15	6.6-7.3	<2	Low	Low	Low	0.17	2	5
Eckley	5-15	0.6-2.0	0.13-0.18	6.6-7.3	<2	Moderate	Moderate	Low	0.15		
	15-60	>6.0	0.03-0.06	6.6-7.8	<2	Low	Moderate	Moderate	0.10		
16*:											
Glenberg	0-8	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low	Moderate	Moderate	0.24	5	3
	8-60	2.0-6.0	0.07-0.12	7.4-8.4	<2	Low	High	Moderate	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm						
16*:											
Bankard	0-19	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low	Moderate	Moderate	0.10	5	3
	19-60	>20	0.05-0.08	7.4-8.4	<2	Low	Moderate	Moderate	0.10		
17 Haverson	0-14	0.6-2.0	0.14-0.18	6.6-8.4	<8	Low	High	Moderate	0.28	5	4L
	14-60	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low	High	Moderate	0.28		
18 Haxtun	0-10	6.0-20	0.07-0.11	6.6-7.8	<2	Low	Low	Low	0.10	5	2
	10-20	0.6-2.0	0.11-0.14	6.6-7.8	<2	Low	Low	Low	0.24		
	20-41	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.32		
	41-60	0.6-2.0	0.10-0.18	7.4-8.4	<2	Low	High	Moderate	0.24		
19 Haxtun	0-7	2.0-6.0	0.11-0.14	6.6-7.3	<2	Low	Low	Low	0.15	5	3
	7-20	0.6-2.0	0.11-0.14	6.6-7.3	<2	Low	Low	Low	0.24		
	20-33	0.6-2.0	0.18-0.20	7.4-7.8	<2	Moderate	Moderate	Low	0.32		
	33-60	0.6-2.0	0.10-0.18	7.4-8.4	<2	Low	High	Moderate	0.24		
20 Iliff	0-6	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Low	Low	0.32	2	6
	6-18	0.06-0.2	0.16-0.20	6.6-8.4	<2	High	High	Low	0.37		
	18-26	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	High	Moderate	0.32		
	26	---	---	---	---	---	---	---	---		
21 Inavale	0-16	>6.0	0.10-0.12	6.6-8.4	<2	Low	High	Low	0.17	5	2
	16-52	6.0-20	0.09-0.11	6.6-8.4	<2	Low	High	Low	0.17		
	52-60	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low	High	Low	0.17		
22 Julesburg	0-11	6.0-20	0.08-0.12	6.6-7.8	<2	Low	Low	Low	0.20	5	2
	11-34	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.24		
	34-60	6.0-20	0.05-0.13	7.4-7.8	<2	Low	Low	Low	0.20		
23 Julesburg	0-11	6.0-20	0.08-0.12	6.6-7.8	<2	Low	Low	Low	0.20	5	2
	11-19	6.0-20	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.24		
	19-60	>6.0	0.05-0.10	7.4-7.8	<2	Low	Low	Low	0.20		
24 Kim	0-16	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	Moderate	Low	0.32	5	4L
	16-60	0.2-0.6	0.19-0.21	7.9-8.4	<2	Moderate	Moderate	Low	0.32		
25*:											
Kuma	0-10	0.6-2.0	0.18-0.21	6.6-8.4	<2	Low	Moderate	Low	0.32	5	5
	10-30	0.2-0.6	0.18-0.21	6.6-8.4	<2	Low	High	Moderate	0.37		
	30-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	Moderate	Moderate	0.32		
Keith	0-4	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	Low	Low	0.32	5	6
	4-15	0.6-2.0	0.20-0.22	6.6-7.8	<2	Moderate	Moderate	Low	0.43		
	15-60	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low	Moderate	Moderate	0.43		
26 Laird	0-27	2.0-6.0	0.09-0.15	7.4-8.4	<2	Low	High	Moderate	0.17	5	3
	27-46	0.6-2.0	0.14-0.16	7.9-9.0	2-8	Low	High	Moderate	0.24		
	46-60	6.0-20	0.05-0.08	7.9-9.0	<2	Low	High	Moderate	0.15		
27 Las Animas	0-7	2.0-6.0	0.11-0.15	7.4-8.4	2-16	Low	High	Moderate	0.17	5	3
	7-60	2.0-6.0	0.07-0.12	7.9-9.0	2-8	Low	High	Moderate	0.17		
28 Las Animas	0-7	0.6-2.0	0.15-0.18	7.4-8.4	2-16	Low	High	Moderate	0.17	5	3
	7-60	2.0-6.0	0.07-0.12	7.4-8.4	2-8	Low	High	Moderate	0.17		
29 Manter	0-6	6.0-20	0.08-0.12	6.6-7.8	<2	Low	Moderate	Low	0.10	5	2
	6-21	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	Moderate	Low	0.15		
	21-60	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low	Moderate	Moderate	0.15		
30, 31 Manter	0-6	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low	Moderate	Low	0.15	5	3
	6-28	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	Moderate	Low	0.15		
	28-60	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low	Moderate	Moderate	0.15		
32 Paoli	0-5	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low	Low	Low	0.17	5	3
	5-32	2.0-6.0	0.14-0.17	7.4-7.8	<2	Low	High	Low	0.20		
	32-60	2.0-6.0	0.12-0.14	7.4-8.4	<2	Low	Low	Moderate	0.20		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
33*. Pits											
34, 35 Platner	0-6	0.6-6.0	0.13-0.18	6.6-7.8	<2	Low	Low	Low	0.32	5	3
	6-16	0.06-0.2	0.16-0.20	6.6-7.8	<2	High	Moderate	Low	0.20		
	16-36	0.6-2.0	0.16-0.18	7.9-8.4	<2	Moderate	Moderate	Moderate	0.32		
	36-60	2.0-6.0	0.09-0.16	7.9-8.4	<2	Low	Moderate	Moderate	0.28		
36 Platte	0-6	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	High	Moderate	---	---	3
	6-13	6.0-20	0.07-0.18	7.4-8.4	<2	Low	High	Moderate	---		
	13-60	>20	0.02-0.04	7.4-8.4	<2	Low	High	Moderate	---		
37 Rago	0-8	0.6-2.0	0.17-0.20	6.6-7.3	<2	Low	Low	Low	0.32	5	5
	8-29	0.06-0.2	0.18-0.21	6.6-8.4	<2	Moderate	Moderate	Low	0.28		
	29-60	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	Moderate	Moderate	0.37		
38 Rago	0-10	0.2-2.0	0.17-0.20	6.6-7.3	<2	Moderate	Moderate	Low	0.32	5	5
	10-32	0.06-0.2	0.17-0.20	6.6-7.8	<2	Moderate	Moderate	Low	0.37		
	32-60	0.2-0.6	0.10-0.18	7.9-8.4	<2	Low	Moderate	Moderate	0.28		
39*:											
Razor	0-4	0.06-0.2	0.12-0.18	7.4-8.4	<2	Moderate	High	Moderate	0.37	1	6
	4-28	0.06-0.2	0.12-0.18	7.4-8.4	<4	High	High	Moderate	0.37		
	28	---	---	---	---	---	---	---	---		
Midway	0-13	0.06-0.2	0.12-0.17	7.9-9.0	2-8	High	High	Moderate	0.43	1	4
	13	---	---	---	---	---	---	---	---		
40 Richfield	0-3	0.6-2.0	0.21-0.24	6.6-7.8	<2	Low	Moderate	Low	0.37	5-4	6
	3-19	0.2-0.6	0.12-0.19	6.6-8.4	<2	High	High	Low	0.37		
	19-60	0.6-2.0	0.18-0.22	7.9-9.0	<2	Low	Moderate	Moderate	0.37		
41 Stoneham	0-3	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	Moderate	Low	0.20	5	5
	3-7	0.6-2.0	0.14-0.18	7.4-8.4	<2	Moderate	Moderate	Low	0.20		
	7-60	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low	High	Moderate	0.20		
42 Terry	0-7	6.0-20	0.06-0.10	6.6-7.8	<2	Low	Moderate	Low	0.17	2	2
	7-21	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	Moderate	Low	0.20		
	21-26	2.0-6.0	0.13-0.15	7.9-8.4	<2	Low	High	Moderate	0.20		
	26	---	---	---	---	---	---	---	---		
43, 44, 45 Valent	0-4	>20	0.05-0.10	6.6-7.8	<2	Low	Low	Low	0.10	5	1
	4-60	>20	0.05-0.10	6.6-7.8	<2	Low	Low	Low	0.10		
46*:											
Valent	0-4	>20	0.05-0.10	6.6-7.8	<2	Low	Low	Low	0.10	5	1
	4-60	>20	0.05-0.10	6.6-7.8	<2	Low	Low	Low	0.10		
Blownout land.											
47 Vona	0-18	6.0-20	0.09-0.11	6.6-7.8	<2	Low	Low	Low	0.10	5	2
	18-44	2.0-6.0	0.12-0.14	6.6-8.4	<4	Low	High	Low	0.10		
	44-60	6.0-20	0.08-0.11	7.4-8.4	<4	Low	High	Moderate	0.10		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
1-----------------Albinas	B	Rare to occasional.	Very brief	Apr-Jun	>6.0	---	---	>60	---	Low.
2, 3, 4, 5--------Ascalon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
6-----------------Bankard	A	Frequent----	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Low.
7-----------------Bayard	A	None--------	---	---	>6.0	---	---	>60	---	Moderate.
8*:										
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Rippable	Low.
Dioxice----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
9*:										
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Rippable	Low.
Rock outcrop.										
10, 11------------Colby	B	None--------	---	---	>6.0	---	---	>60	---	Low.
12*:										
Colby------------	B	None--------	---	---	>6.0	---	---	>60	---	Low.
Torriorthents.										
13----------------Dailey	A	None--------	---	---	>6.0	---	---	>60	---	Low.
14*:										
Dwyer------------	A	None--------	---	---	>6.0	---	---	>60	---	Low.
Vona-------------	B	None--------	---	---	>6.0	---	---	>60	---	Low.
15----------------Eckley	B	None--------	---	---	>6.0	---	---	>60	---	Low.
16*:										
Glenberg---------	B	Rare to occasional.	Very brief	Apr-Aug	>6.0	---	---	>60	---	Low.
Bankard----------	A	Rare to occasional.	Very brief	Mar-Jun	>6.0	---	---	>60	---	Low.
17----------------Haverson	B	Occasional to frequent	Brief-----	May-Sep	>6.0	---	---	>60	---	Low.
18, 19------------Haxtun	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
20----------------Iliff	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate.
21----------------Inavale	A	Rare--------	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
22, 23: Julesburg	A	None	---	---	>6.0	---	---	>60	---	Moderate.
24: Kim	B	None	---	---	>6.0	---	---	>60	---	Low.
25*:										
Kuma	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Keith	B	None	---	---	>6.0	---	---	>60	---	Moderate.
26: Laird	B	None	---	---	>6.0	---	---	>60	---	Moderate.
27, 28: Las Animas	C	Frequent to occasional.	Brief	May-Aug	0-1.5	Apparent	Jan-Dec	>60	---	High.
29, 30, 31: Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate.
32: Paoli	B	Rare to occasional.	Brief	---	>6.0	---	---	>60	---	Moderate.
33*. Pits										
34, 35: Platner	C	None	---	---	>6.0	---	---	>60	---	Low.
36: Platte	B/D	Occasional to frequent	Brief	Apr-Oct	2.0-6.0	Apparent	Apr-Jun	>60	---	Moderate.
37: Rago	C	None	---	---	>6.0	---	---	>60	---	Moderate.
38: Rago	C	Occasional	Brief	Jun-Aug	>6.0	---	---	>60	---	Moderate.
39*:										
Razor	C	None	---	---	>6.0	---	---	20-40	Rippable	Low.
Midway	D	None	---	---	>6.0	---	---	6-20	Rippable	Low.
40: Richfield	C	None	---	---	>6.0	---	---	>60	---	Low.
41: Stoneham	B	None	---	---	>6.0	---	---	>60	---	Low.
42: Terry	B	None	---	---	>6.0	---	---	20-34	Rippable	Low.
43, 44, 45: Valent	A	None	---	---	>6.0	---	---	>60	---	Low.
46*:										
Valent	A	None	---	---	>6.0	---	---	>60	---	Low.
Blownout land.										
47: Vona	B	None	---	---	>6.0	---	---	>60	---	Low.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Albinas	Fine-loamy, mixed, mesic Pachic Argiustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Bayard	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Dailey*	Sandy, mixed, mesic Torriorthentic Haplustolls
Dioxice	Fine-loamy, mixed, mesic Aridic Calciustolls
Dwyer	Mixed, mesic Ustic Torripsamments
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Haxtun	Fine-loamy, mixed, mesic Pachic Argiustolls
Iliff	Fine, montmorillonitic, mesic Aridic Paleustolls
Inavale*	Sandy, mixed, mesic Typic Ustifluvents
Julesburg	Coarse-loamy, mixed, mesic Aridic Argiustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kim	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Laird**	Coarse-loamy, mixed, mesic Aridic Calciustolls
Las Animas	Coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Paoli	Coarse-loamy, mixed, mesic Pachic Haplustolls
Platner	Fine, montmorillonitic, mesic Aridic Paleustolls
Platte	Sandy, mixed, mesic Mollic Fluvaquents
Rago	Fine, montmorillonitic, mesic Pachic Argiustolls
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Richfield	Fine, montmorillonitic, mesic Aridic Argiustolls
Stoneham	Fine-loamy, mixed, mesic Ustollic Haplargids
Terry	Coarse-loamy, mixed, mesic Ustollic Haplargids
Valent*	Mixed, mesic Ustic Torripsamments
Vona	Coarse-loamy, mixed, mesic Ustollic Haplargids

* Dailey, Inavale, and Valent soils in this survey match the Dunday, Elsmere, and Valentine soils, respectively, that are mapped and described in the Soil Survey of Dundy County, Nebraska, 1963. More precise information about the placement of soil series in higher categories has necessitated these changes.

** The Laird series, established by this survey, is the equivalent of the Anselmo series, Marly Substratum Variant, described in the Soil Survey of Phillips County, Colorado, 1971.

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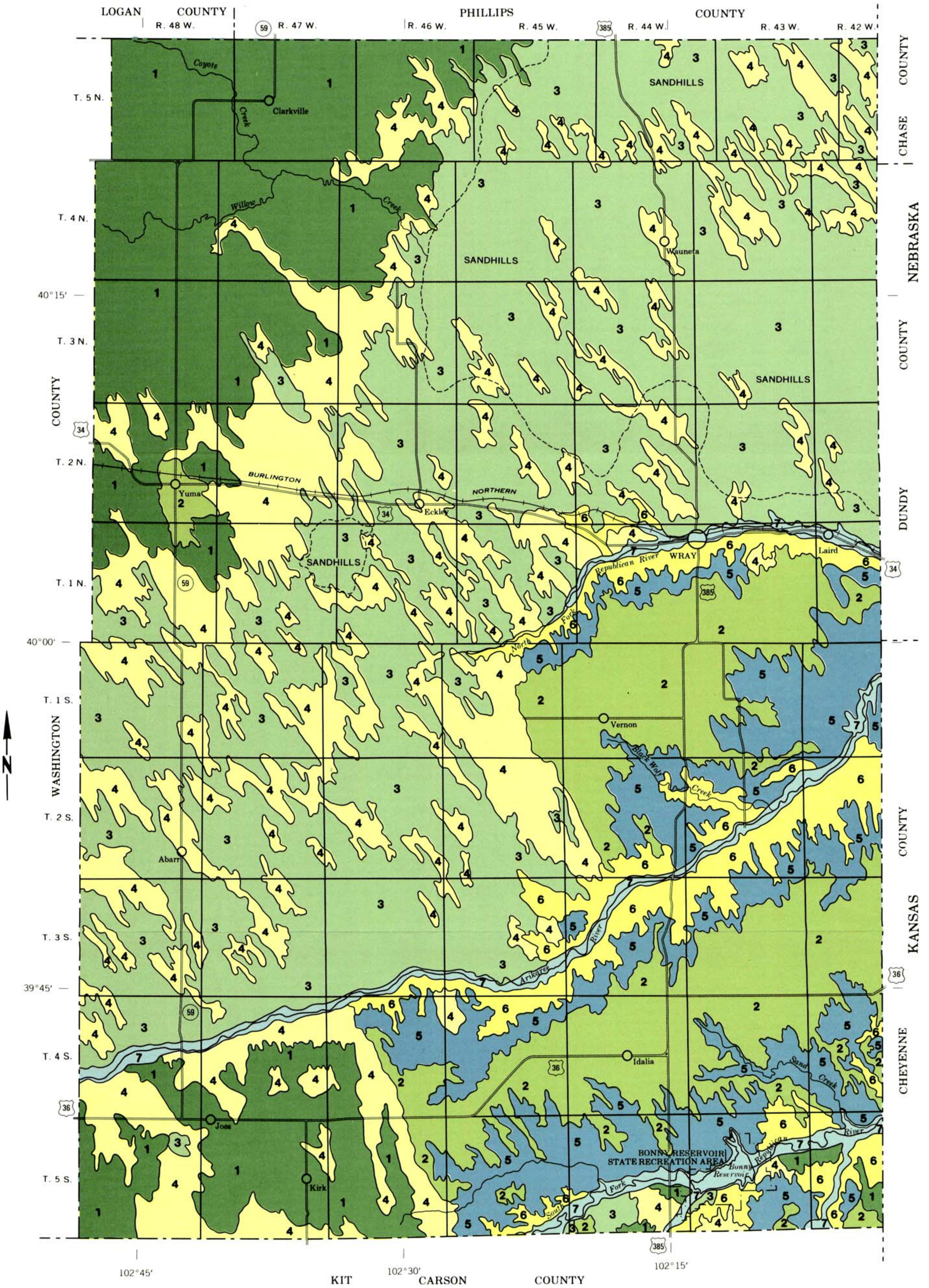


MAP UNITS*

1	Ascalon-Haxtun-Platner: Nearly level to undulating, deep, well drained loamy sands, sandy loams, and loams; on smooth plains
2	Kuma-Keith: Nearly level to gently undulating, deep, well drained silt loams; on smooth plains
3	Valent: Undulating to steep, deep, excessively drained sands; on low sandhills
4	Julesburg-Haxtun-Manter: Nearly level to undulating, deep, well drained loamy sands and sandy loams; on smooth plains and in sandhill valleys
5	Colby: Gently sloping to hilly, deep, well drained silt loams; on low hills
6	Canyon-Bayard: Gently sloping to hilly, shallow and deep loams and fine sandy loams; on fans, ridges, foot slopes, hills, and knolls
7	Bankard-Haverson-Las Animas: Nearly level, deep, somewhat excessively drained, well drained, and poorly drained sands, loams, and fine sandy loams; on flood plains and second-bottom terraces

*The terms for texture used in the descriptive heading apply to the surface layer of the major soils

Compiled 1979

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

YUMA SOIL CONSERVATION DISTRICT
YUMA COUNTY SOIL CONSERVATION DISTRICT
COLORADO AGRICULTURAL EXPERIMENT STATION

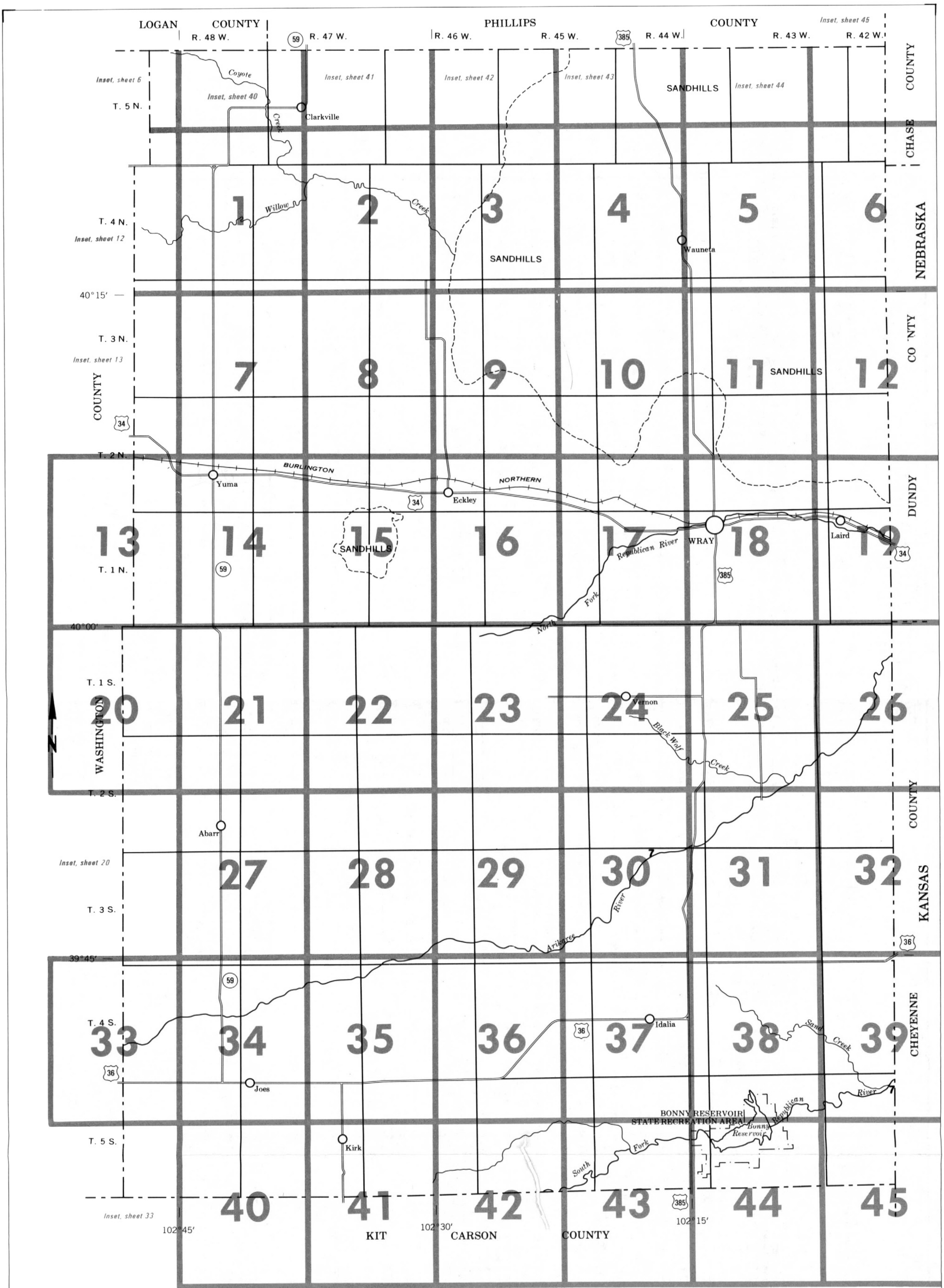
GENERAL SOIL MAP

YUMA COUNTY, COLORADO

Scale 1:316,800

1 0 1 2 3 4 5 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

YUMA COUNTY, COLORADO

Scale 1:316,800

1 0 1 2 3 4 5 Miles

SOIL LEGEND

SYMBOL	NAME
1	Albinas loam
2	Ascalon loamy sand, 3 to 9 percent slopes
3	Ascalon sandy loam, 3 to 5 percent slopes
4	Ascalon sandy loam, 5 to 9 percent slopes
5	Ascalon fine sandy loam, 0 to 3 percent slopes
6	Bankard sand
7	Bayard fine sandy loam, 2 to 6 percent slopes
8	Canyon-Dioxice complex, 1 to 9 percent slopes
9	Canyon-Rock outcrop complex, 9 to 25 percent slopes
10	Colby silt loam, 3 to 6 percent slopes
11	Colby silt loam, 6 to 15 percent slopes
12	Colby-Torriorthents complex, gullied, 15 to 25 percent slopes
13	Dailey loamy sand
14	Dwyer-Vona loamy sands, 3 to 9 percent slopes
15	Eckley gravelly sandy loam, 3 to 7 percent slopes
16	Glenberg-Bankard complex
17	Haverson loam
18	Haxtun loamy sand
19	Haxtun sandy loam
20	Iliff loam
21	Inavale loamy sand
22	Julesburg loamy sand, 0 to 3 percent slopes
23	Julesburg loamy sand, 3 to 7 percent slopes
24	Kim loam, 3 to 6 percent slopes
25	Kuma-Keith silt loams
26	Laird fine sandy loam
27	Las Animas fine sandy loam
28	Las Animas loam
29	Manter loamy sand
30	Manter sandy loam, 2 to 5 percent slopes
31	Manter sandy loam, 5 to 9 percent slopes
32	Paoli sandy loam
33	Pits
34	Platner sandy loam, 3 to 5 percent slopes
35	Platner loam
36	Platte fine sandy loam
37	Rago loam
38	Rago clay loam, occasional overflow
39	Razor-Midway complex, 3 to 9 percent slopes
40	Richfield silt loam
41	Stoneham loam
42	Terry loamy sand
43	Valent sand, 1 to 9 percent slopes
44	Valent sand, 9 to 15 percent slopes
45	Valent sand, 15 to 45 percent slopes
46	Valent-Blownout land complex, 1 to 25 percent slopes
47	Vona loamy sand

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
    - Double-line (label) — CANAL
    - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — SvE 107

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

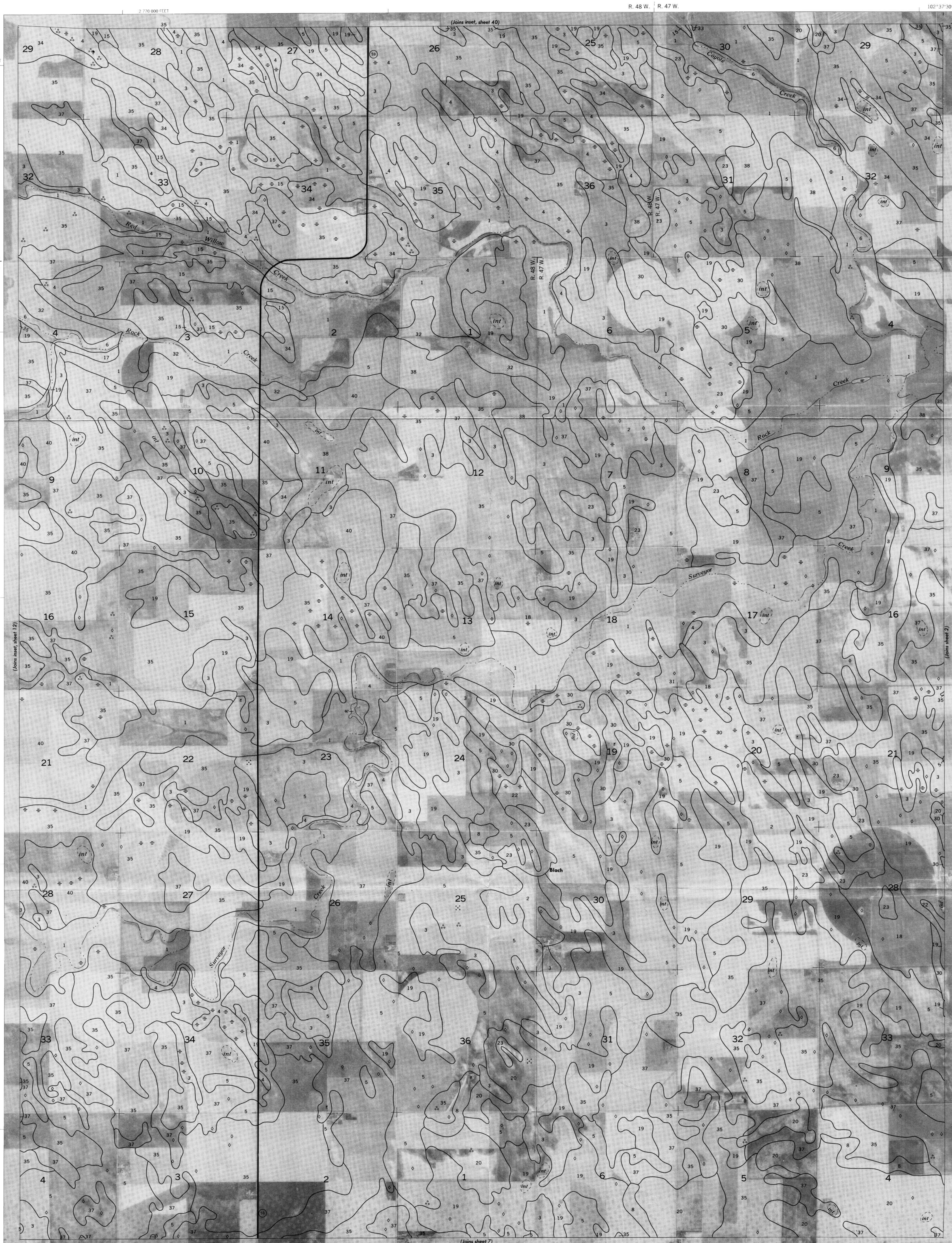
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Shale



1 ½ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 2
YUMA COUNTY, COLORADO
(CLARKVILLE SE QUADRANGLE)

1	¾	½	¼	0	1	2 Miles
5 000	4 000	3 000	2 000	1 000	0	5 000 Feet · 10 000 Feet

Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

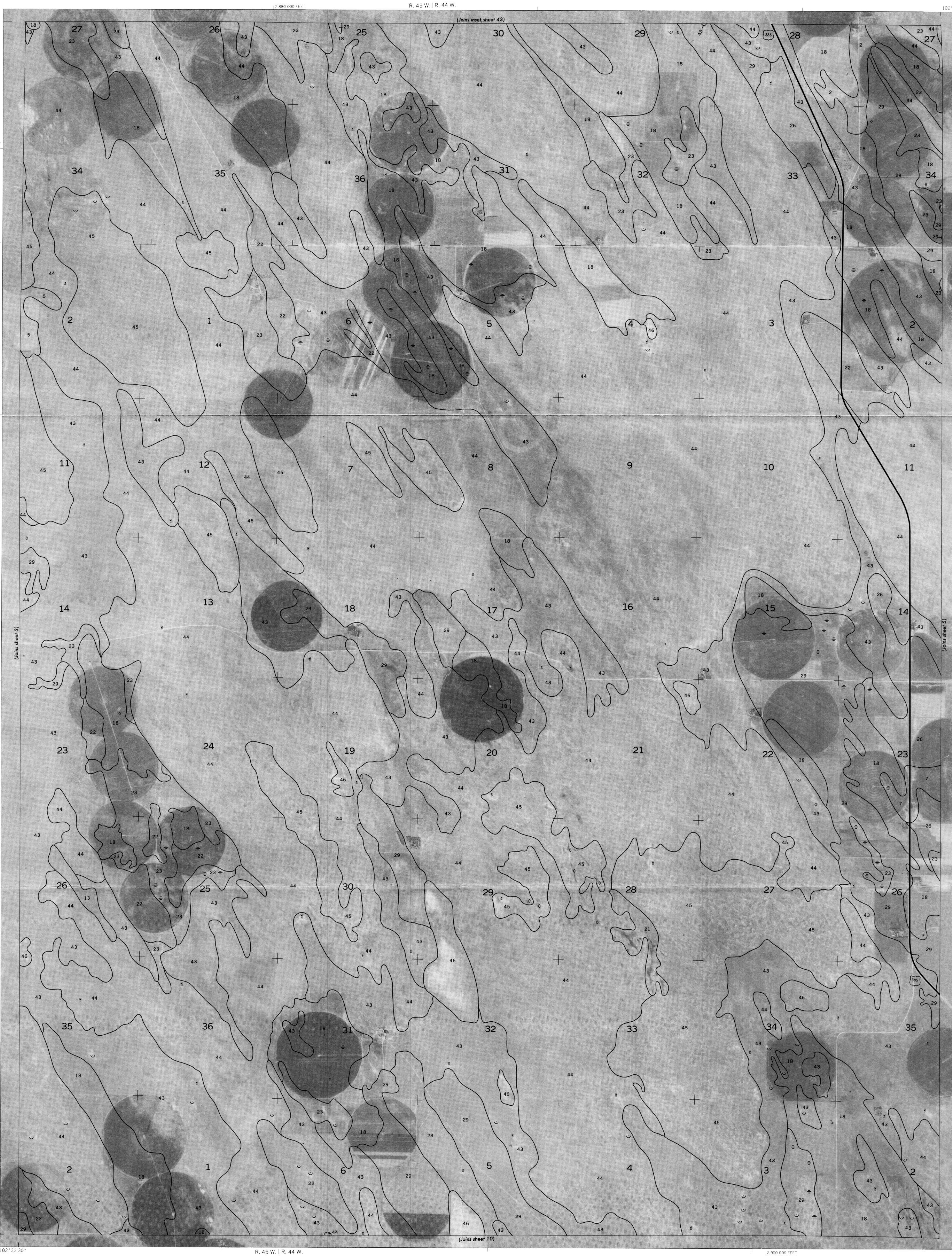
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 Mile ½ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 4
YUMA COUNTY, COLORADO
(WAUNETA QUADRANGLE)



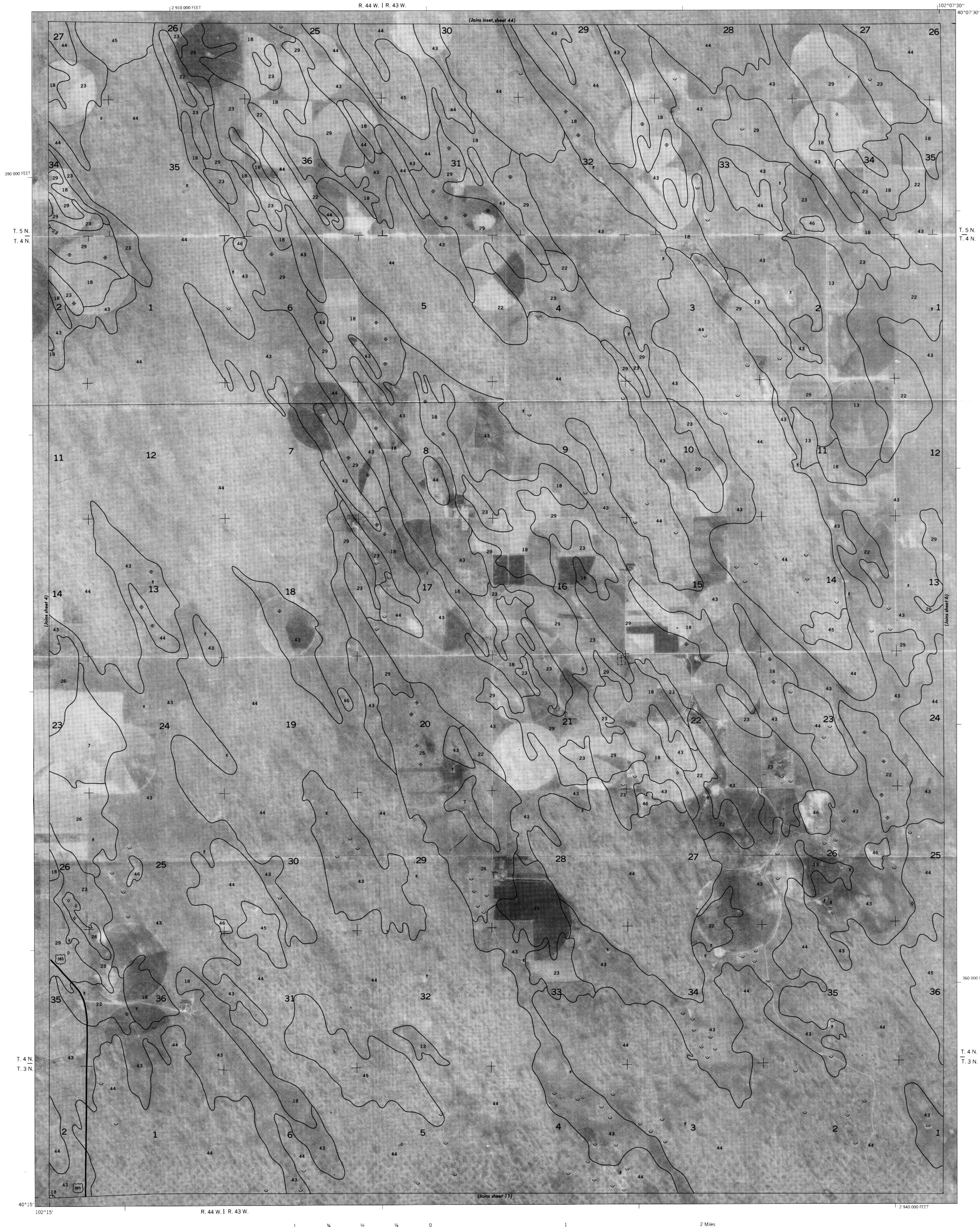
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24 000

1 ½ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

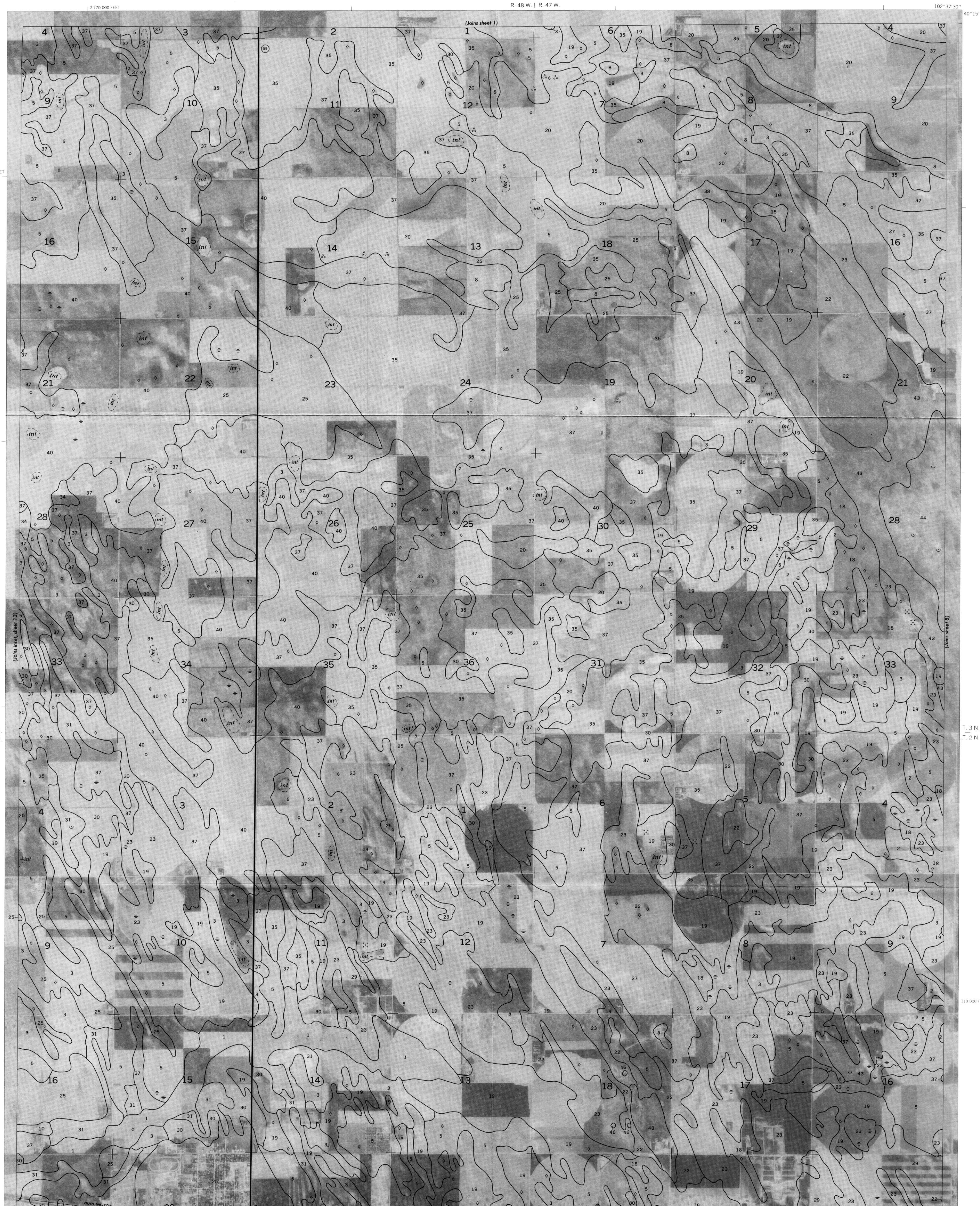
10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 7
YUMA COUNTY, COLORADO
(YUMA NORTH QUADRANGLE)



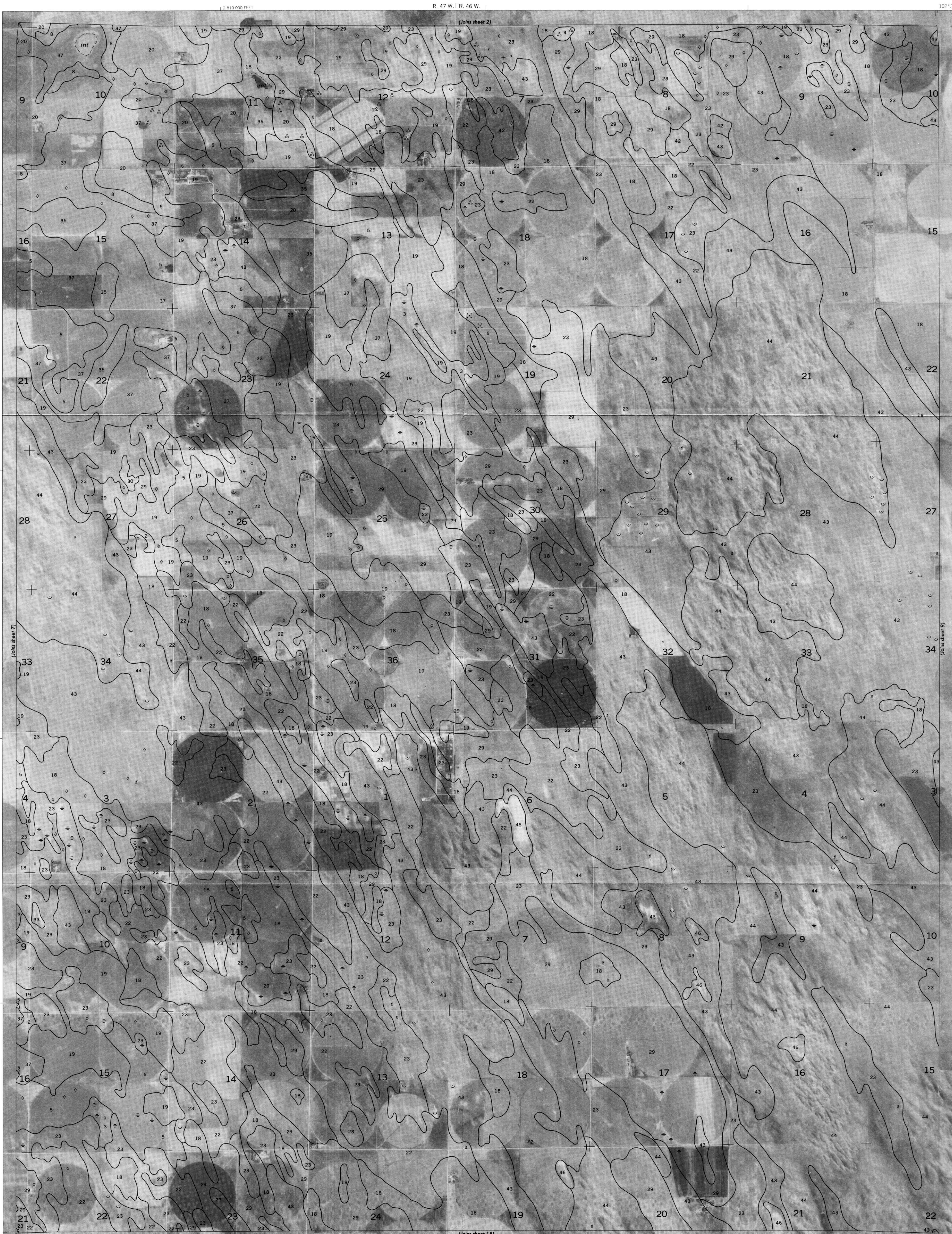
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 8
YUMA COUNTY, COLORADO
(YUMA NE QUADRANGLE)



1 ⅞ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

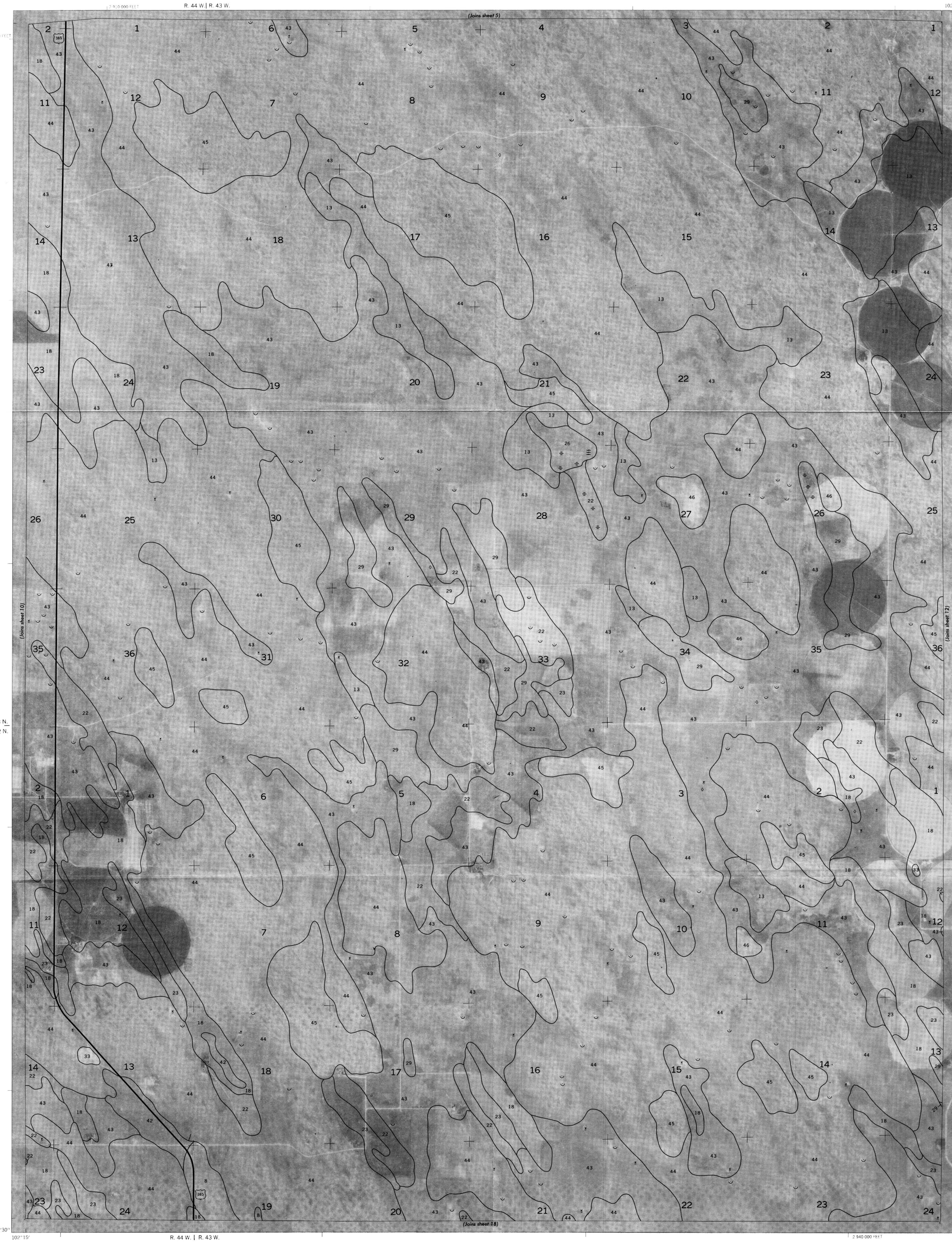
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

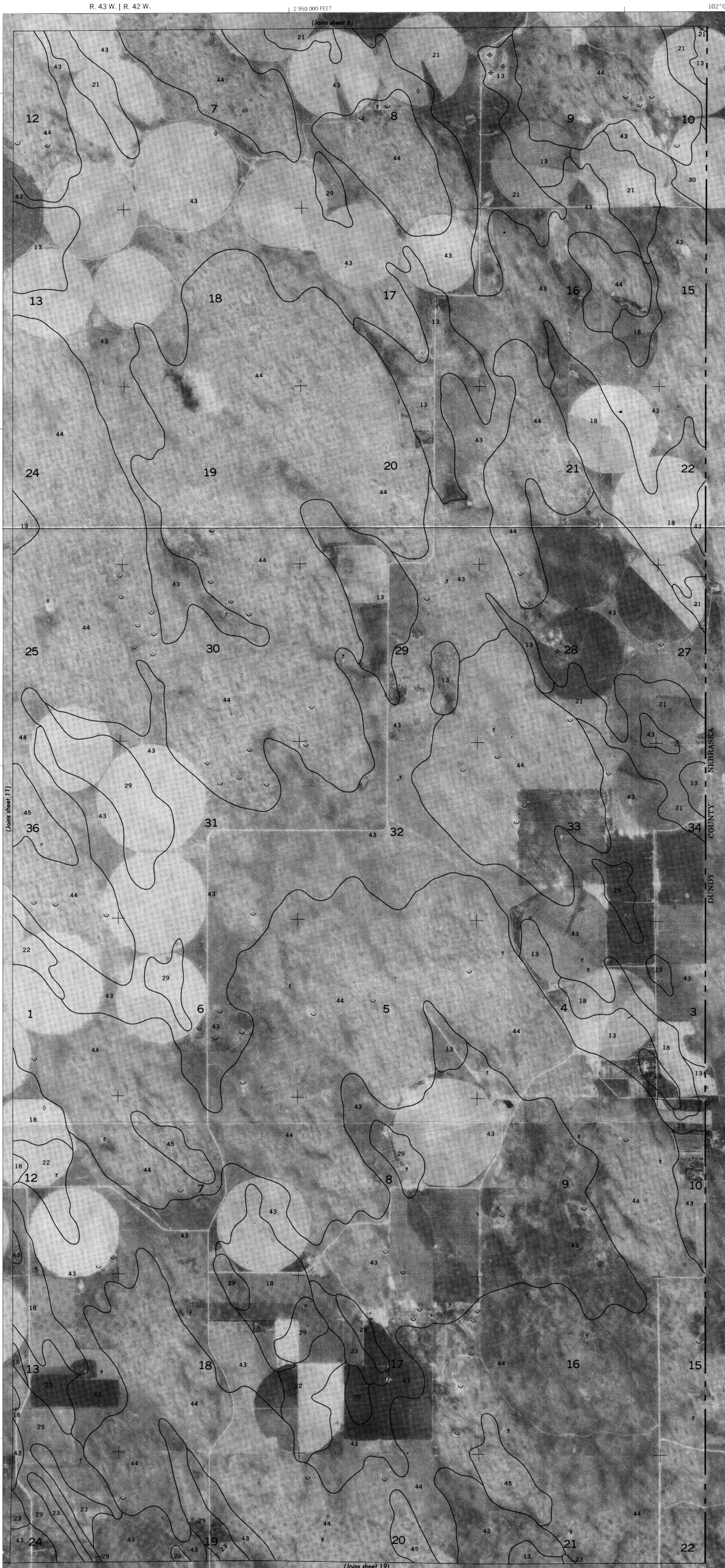
SHEET NO. 11
YUMA COUNTY, COLORADO
(WRAY NW QUADRANGLE)

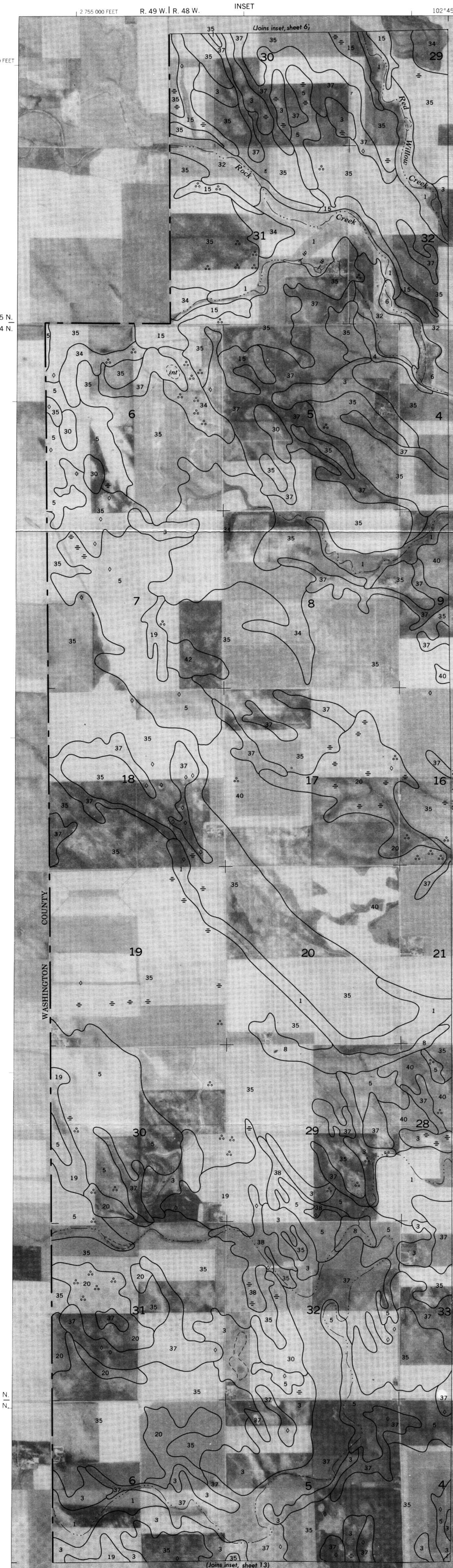


Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.





Scale 1:24 000

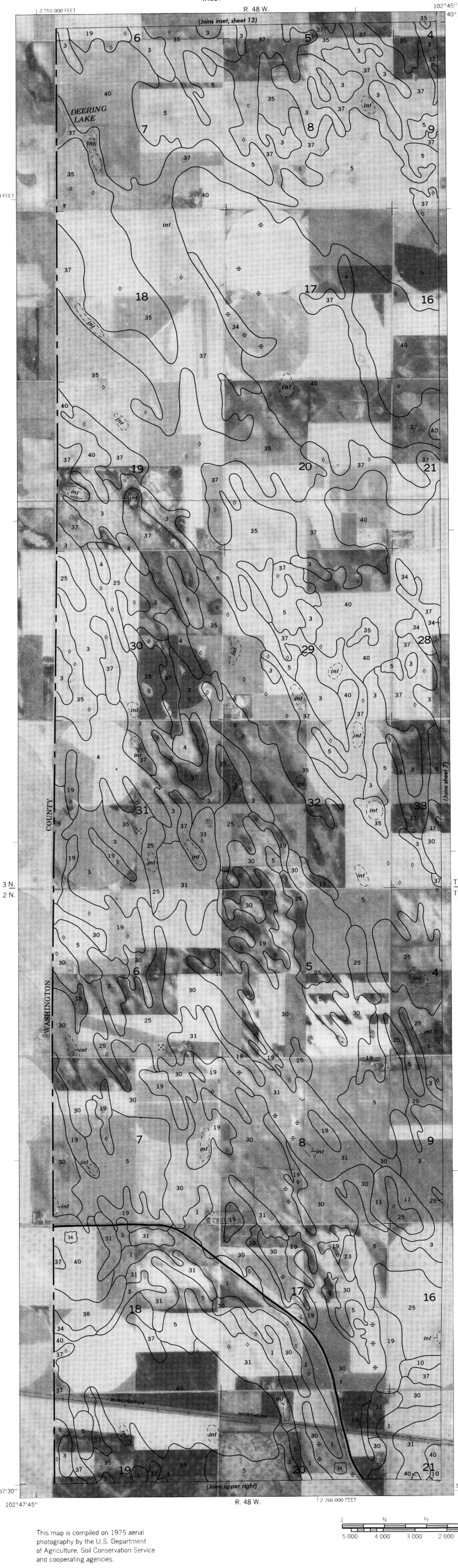
1 ½ 0 1 2 Miles

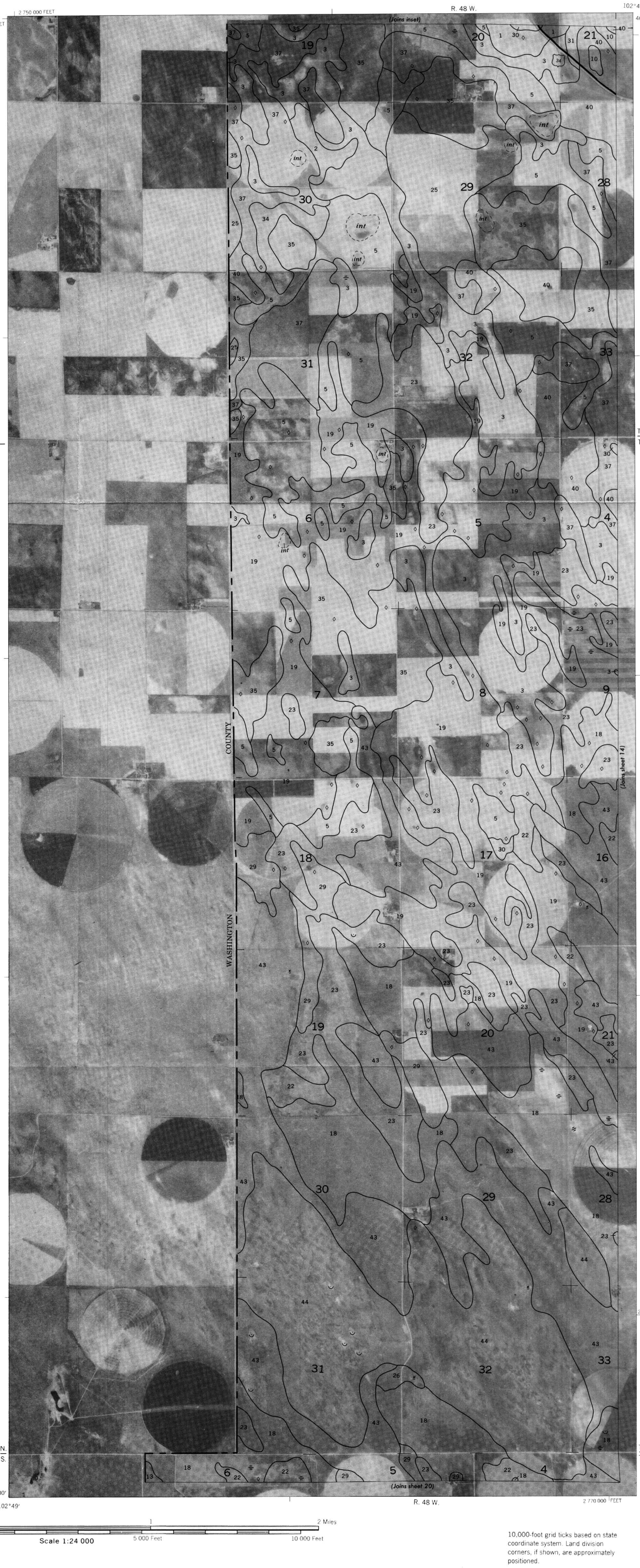
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

INSET





This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

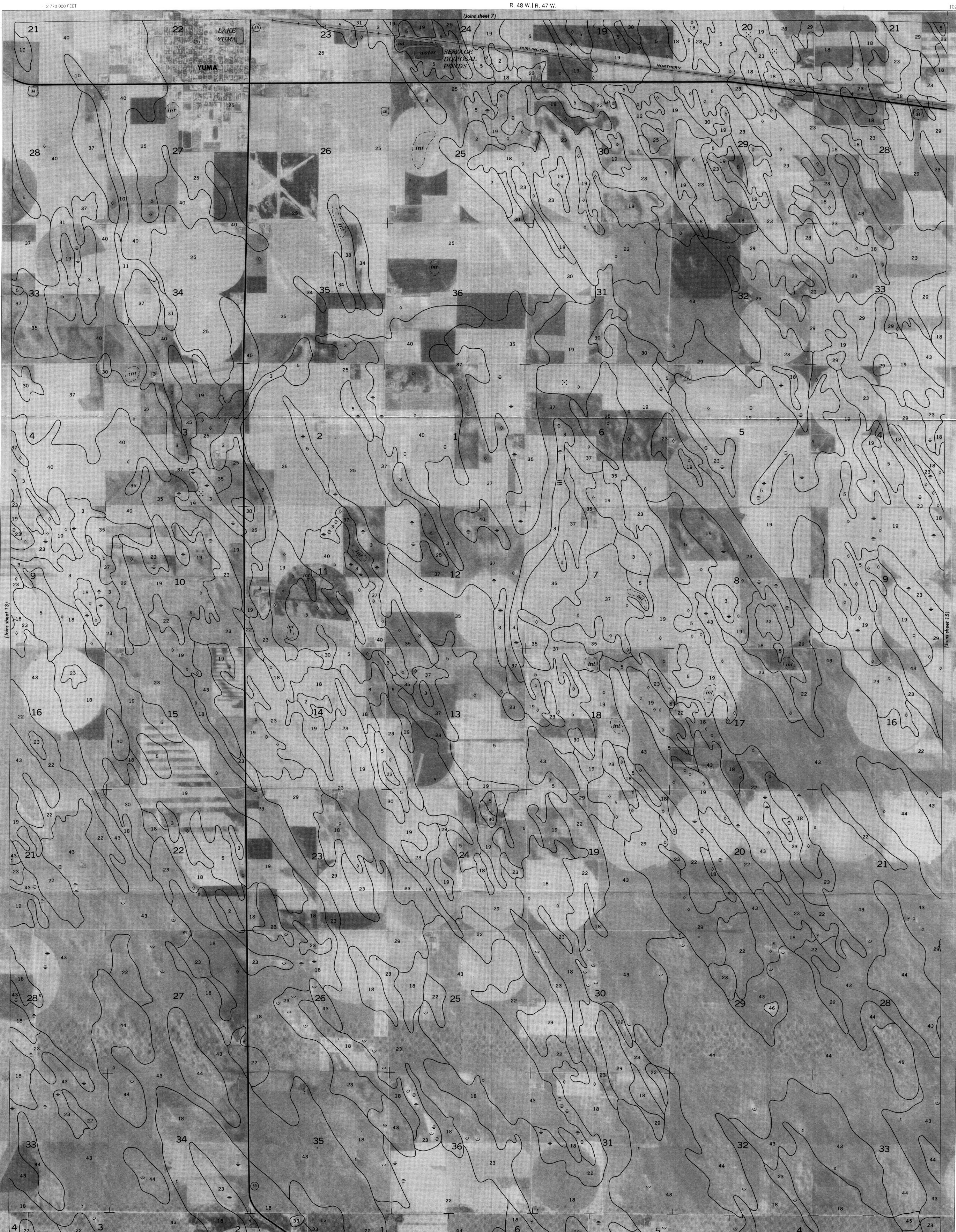
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

R. 48 W. | R. 47 W.

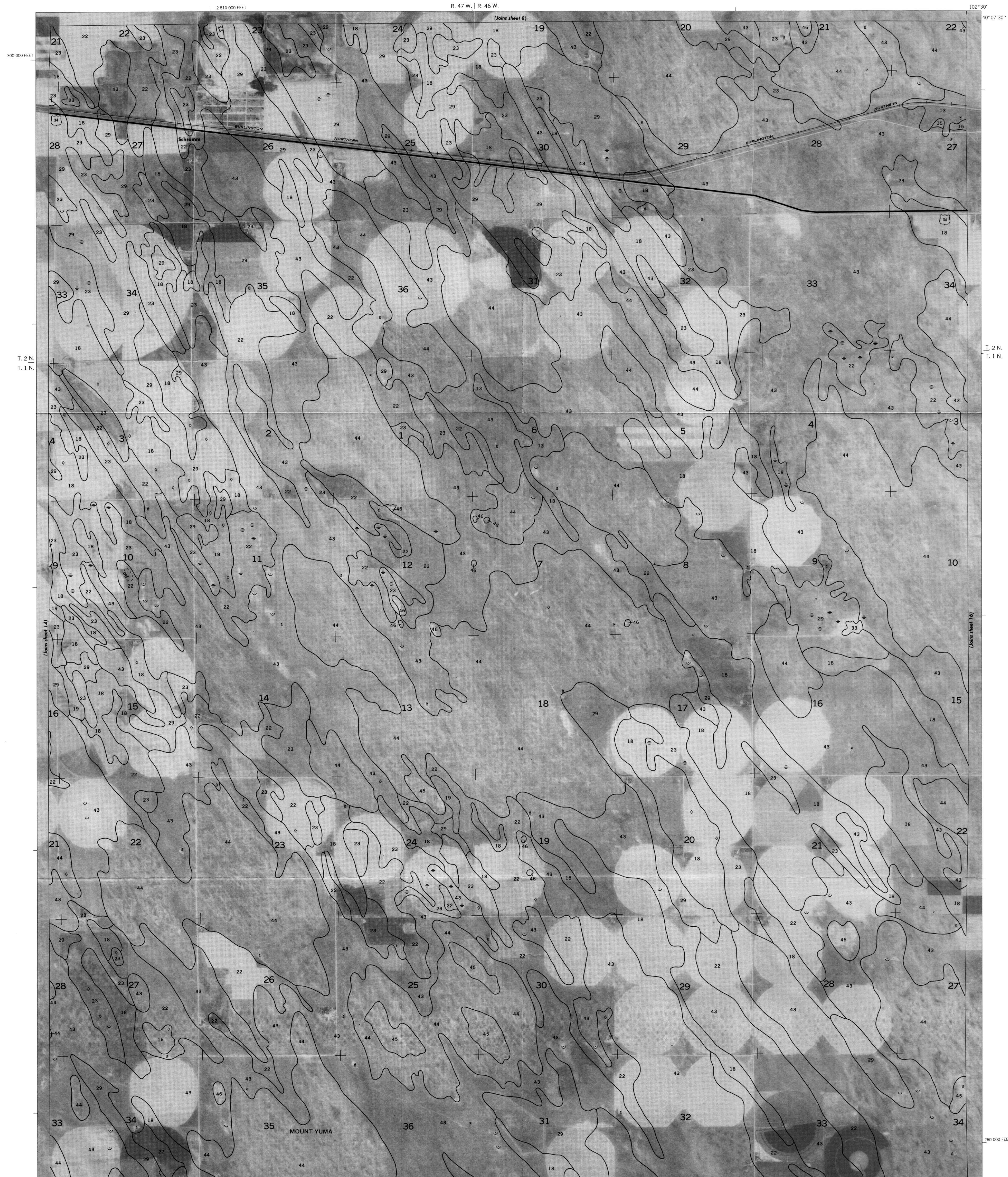


R. 48 W. | R. 47 W.

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

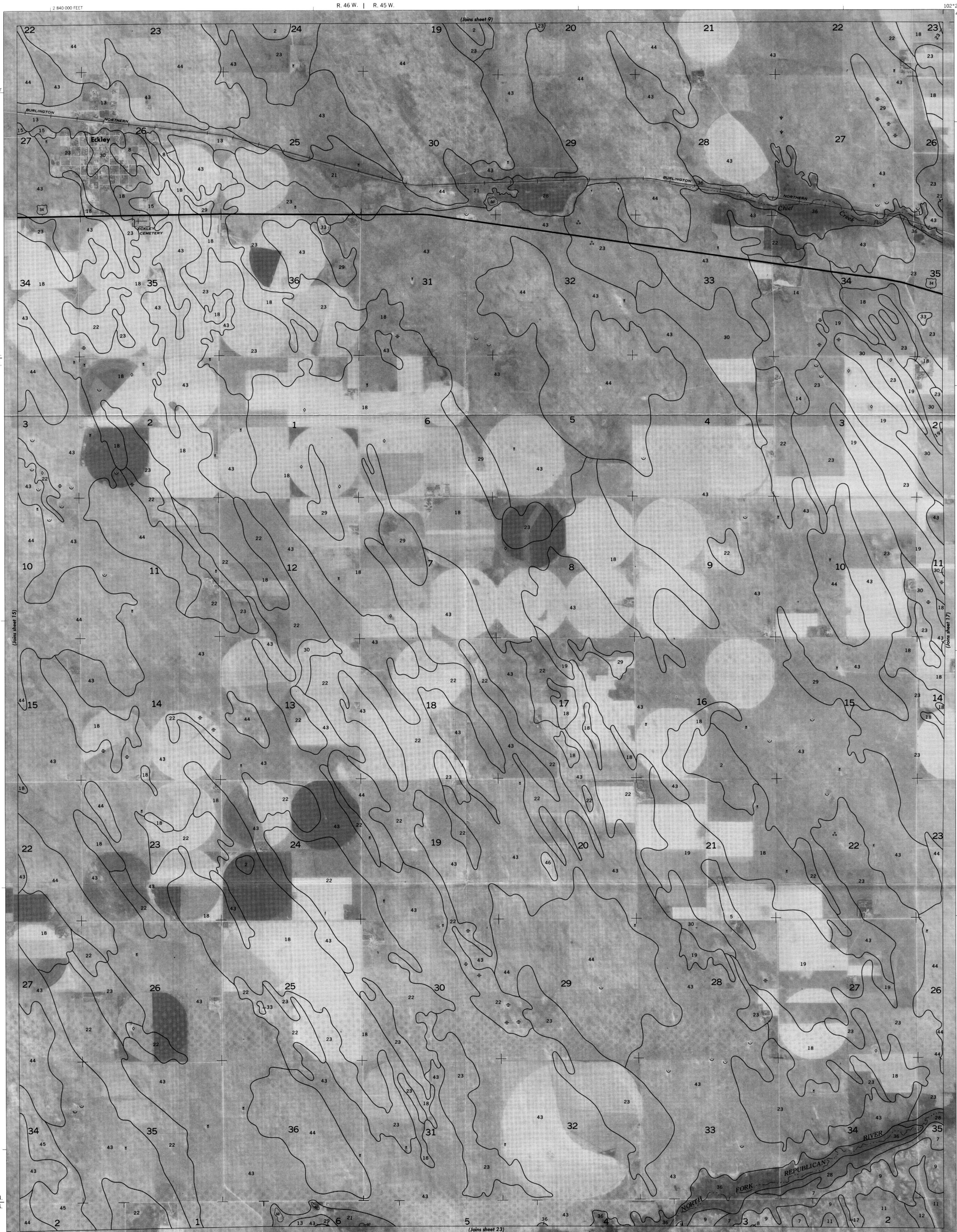
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 16
YUMA COUNTY, COLORADO
(ECKLEY QUADRANGLE)



R. 46 W. R. 45 W.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

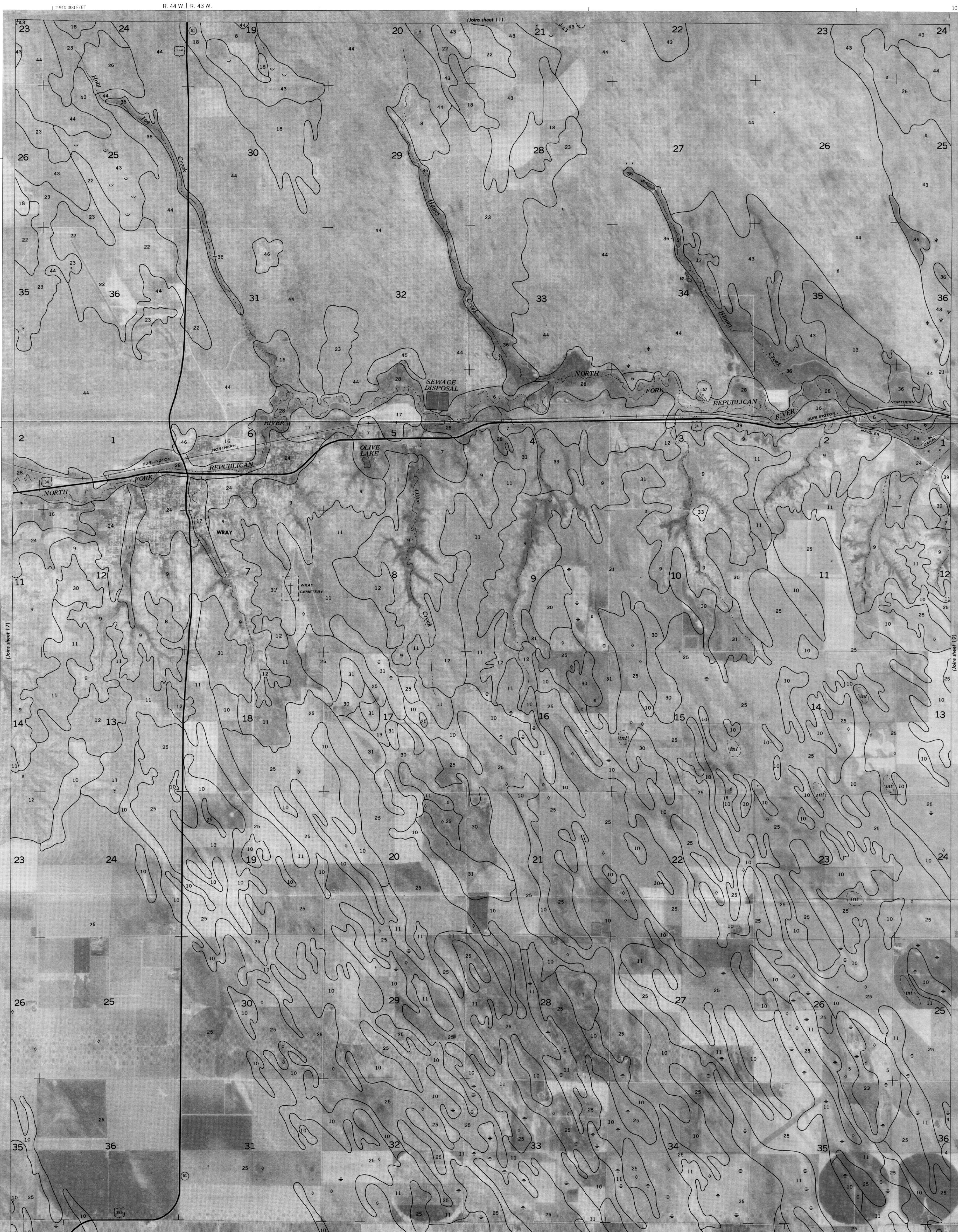
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

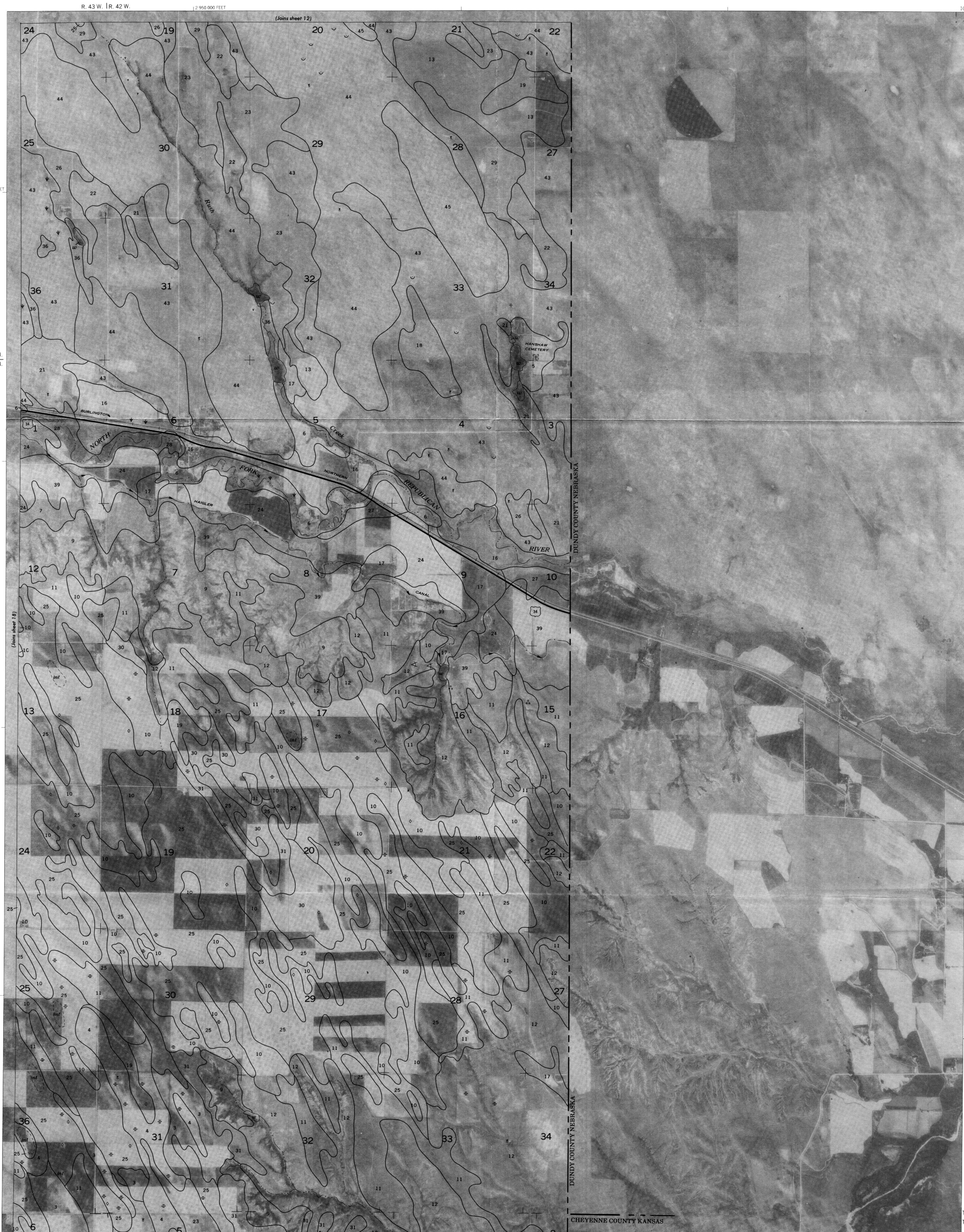


1 ½ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

R. 43 W. | R. 42 W.   2 950 000 FEET   102°00'   40°07'30"



40°00'
102°07'30"   R. 42 W.   2 980 000 FEET

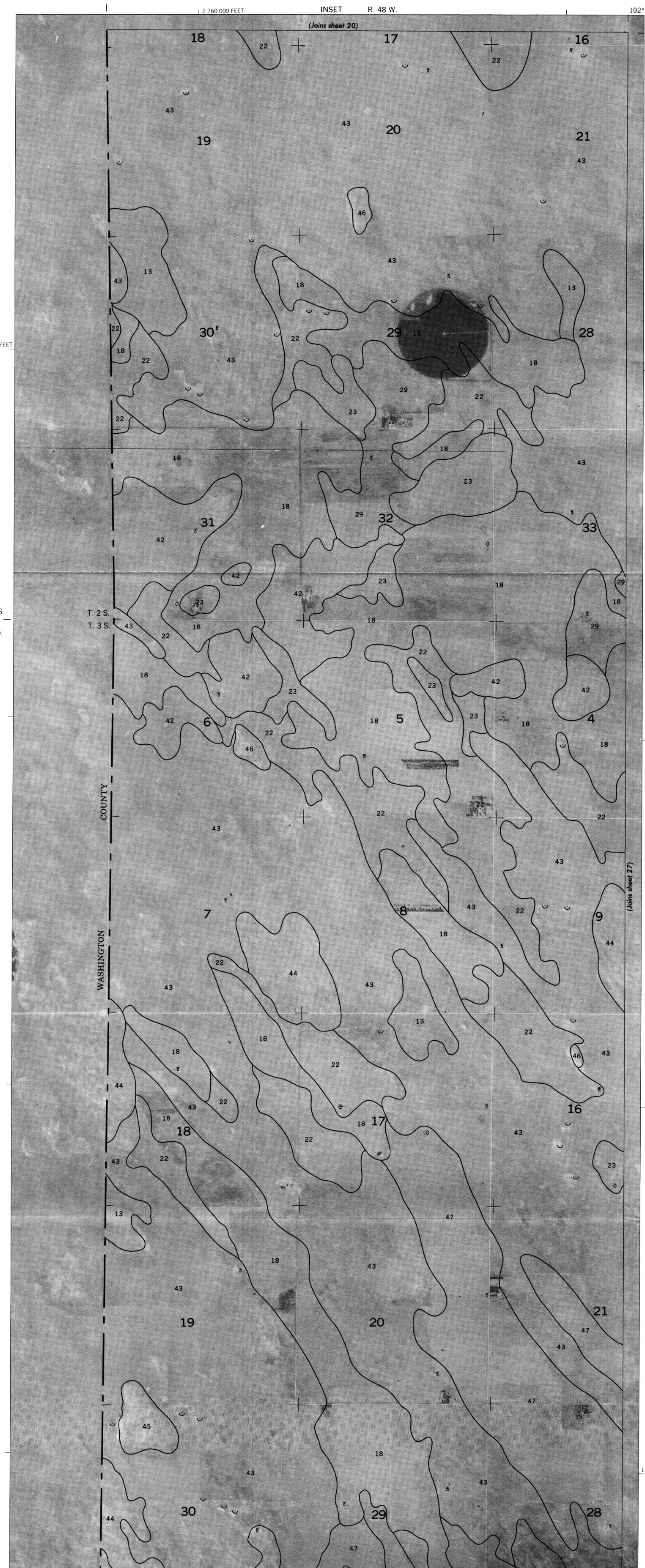
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

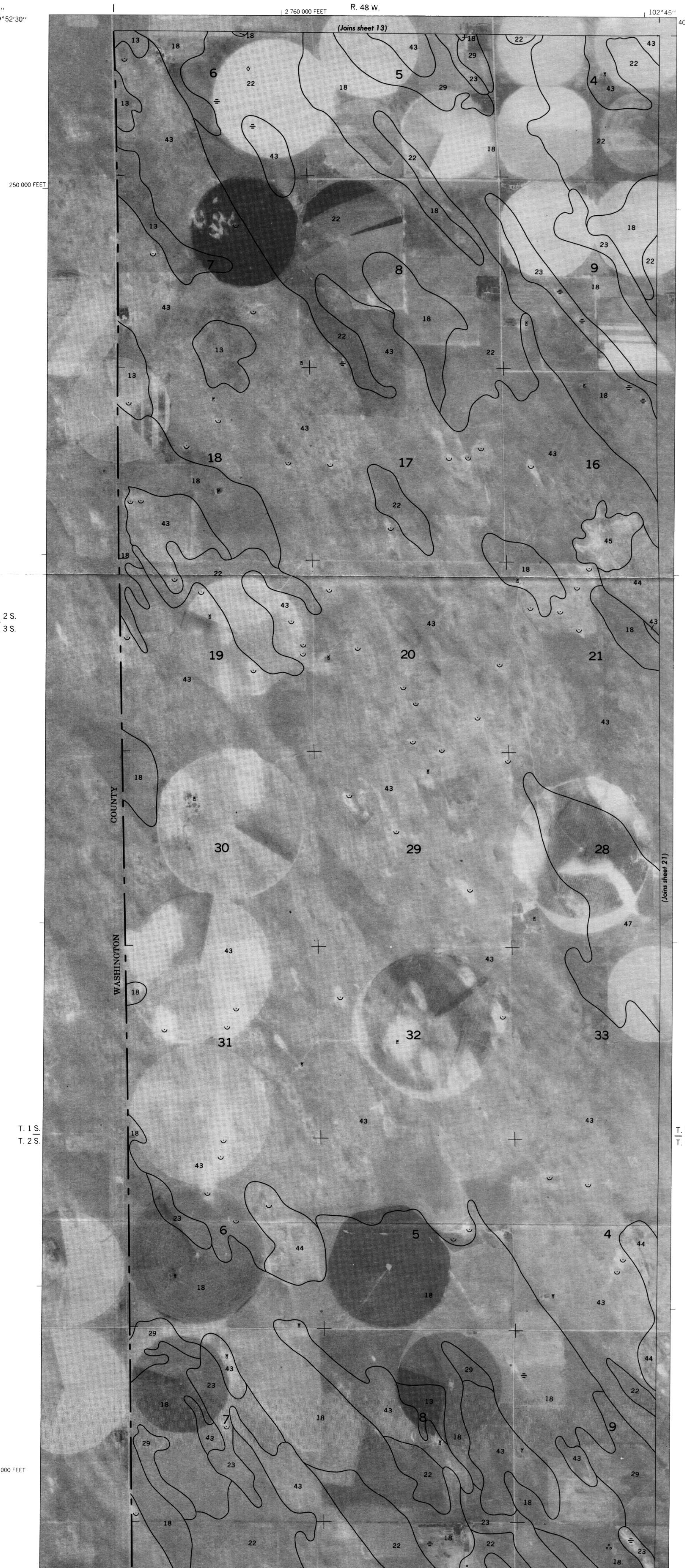
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.





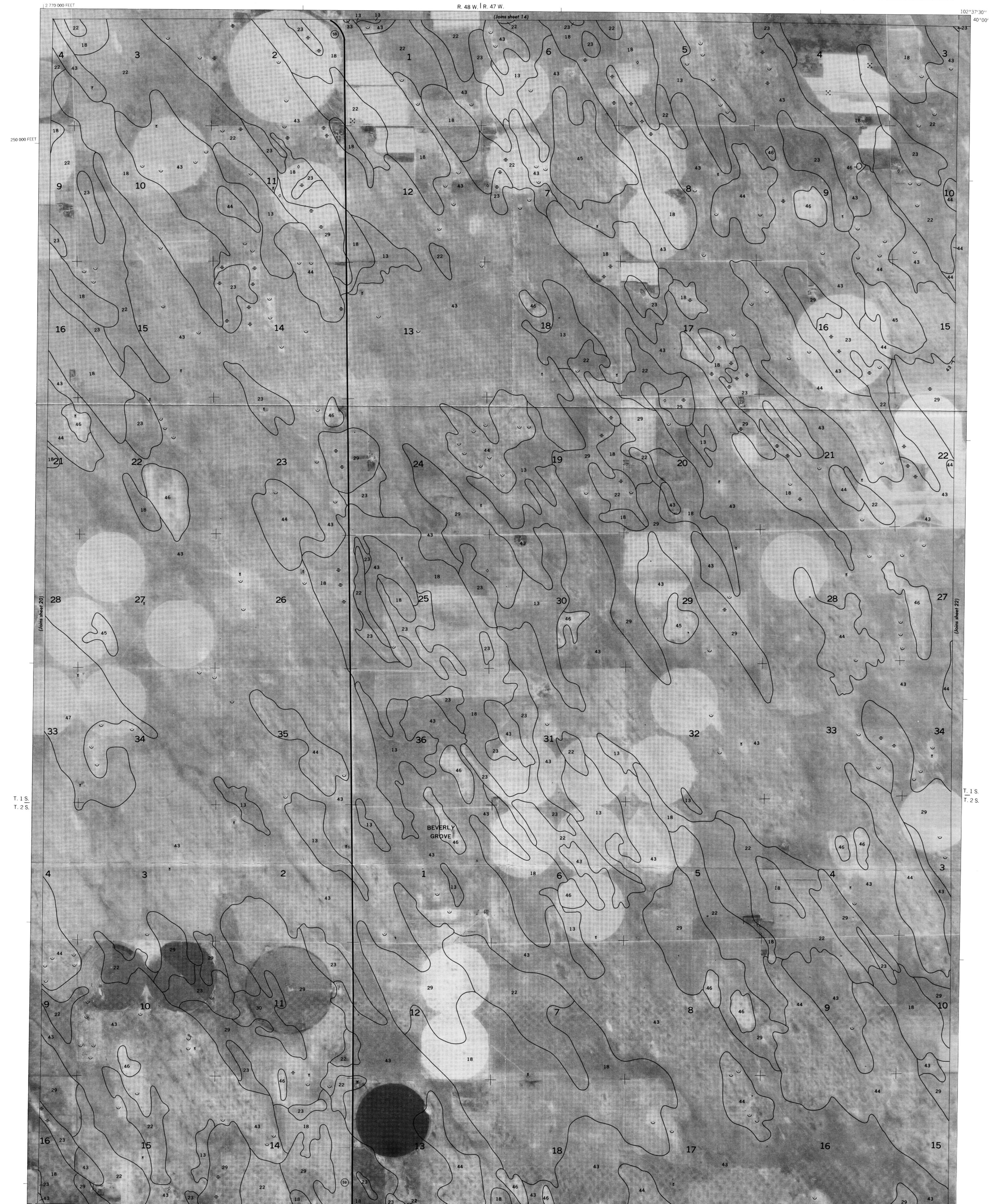
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 21
YUMA COUNTY, COLORADO
(BEVERLY GROVE QUADRANGLE)

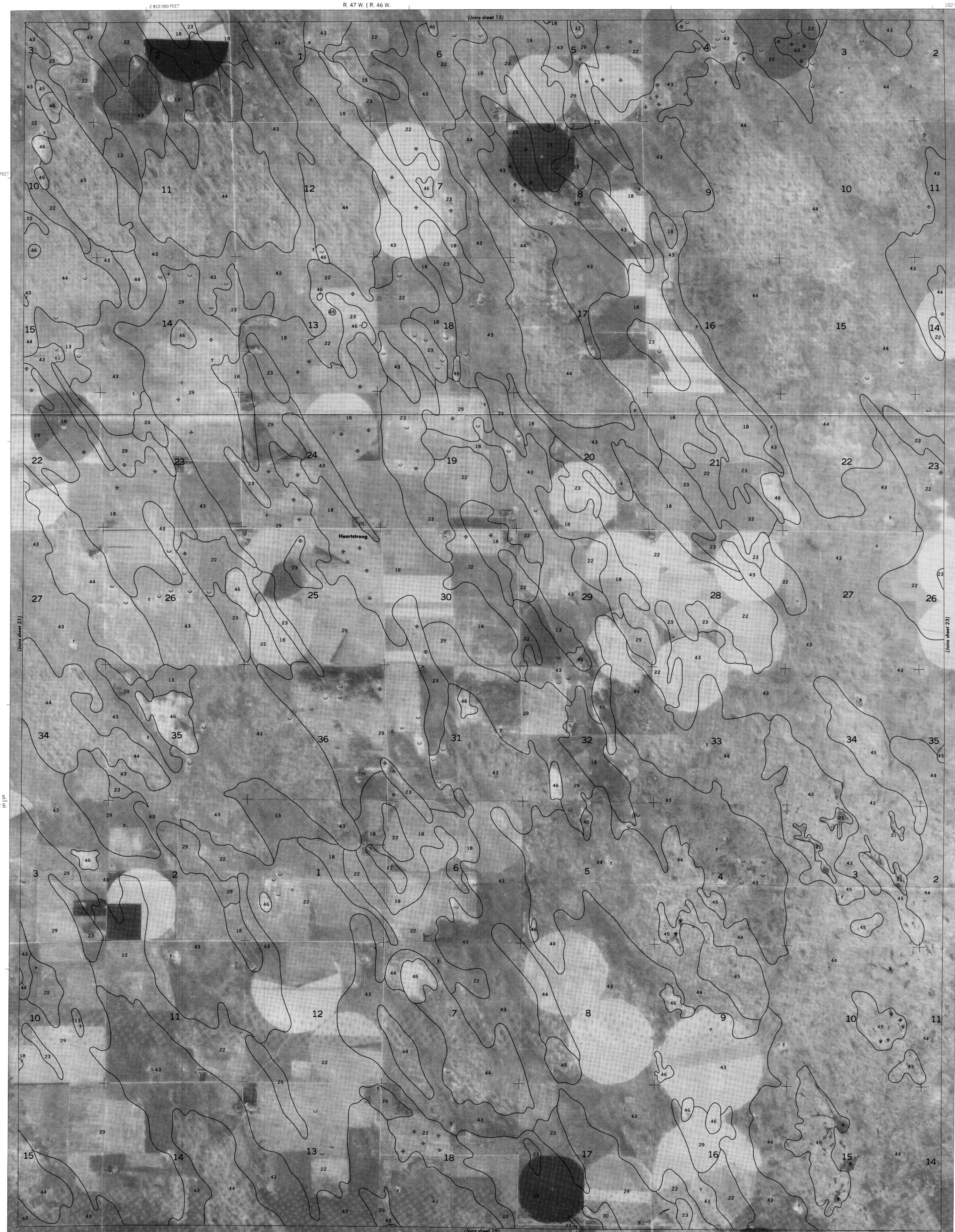


1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 Scale 1:24 000 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

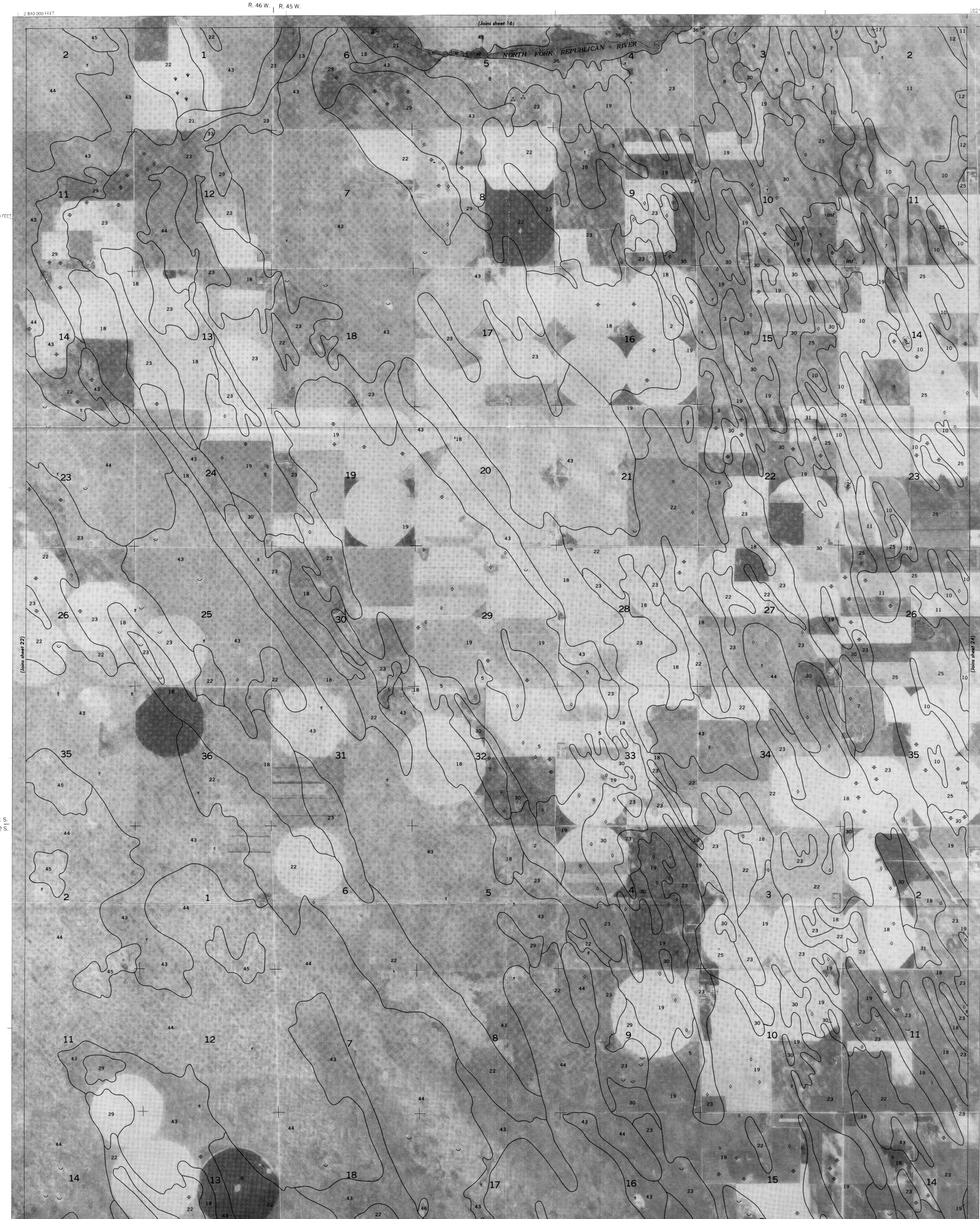


Scale 1:24 000

1 Miles 2 Miles; 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

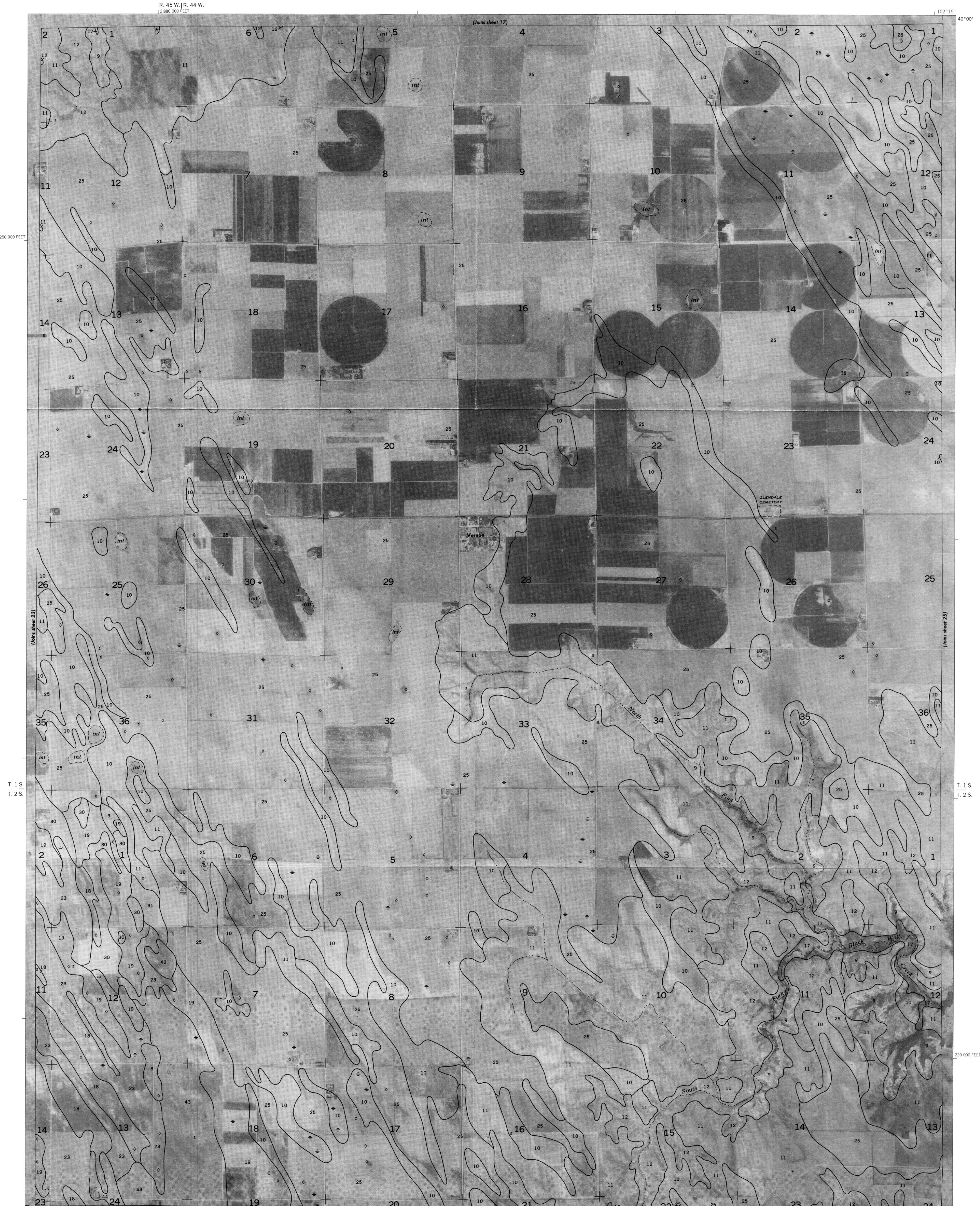
Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 24
YUMA COUNTY, COLORADO
(VERNON QUADRANGLE)



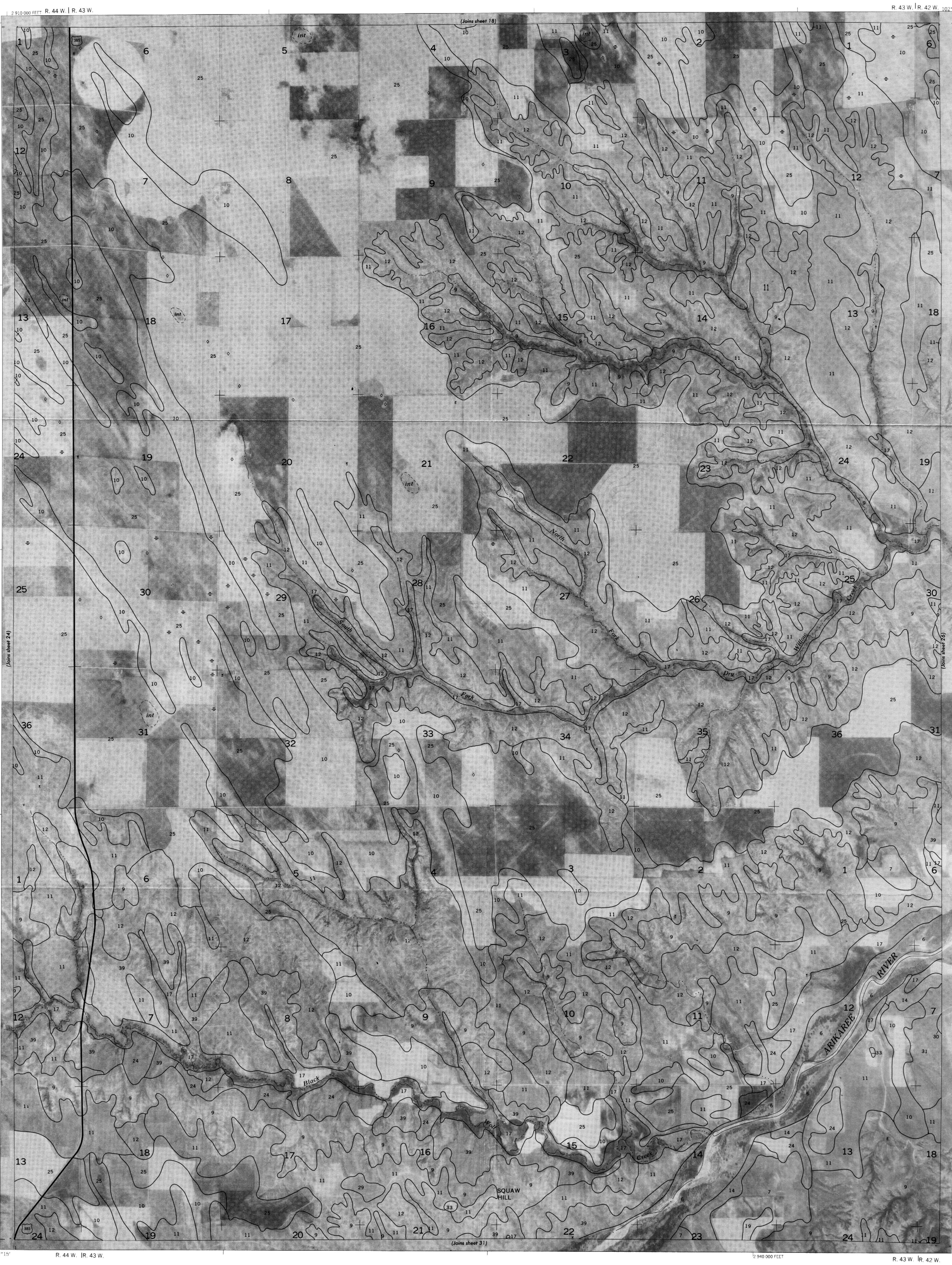
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 25
YUMA COUNTY, COLORADO
(BEECHER ISLAND NW QUADRANGLE)



This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

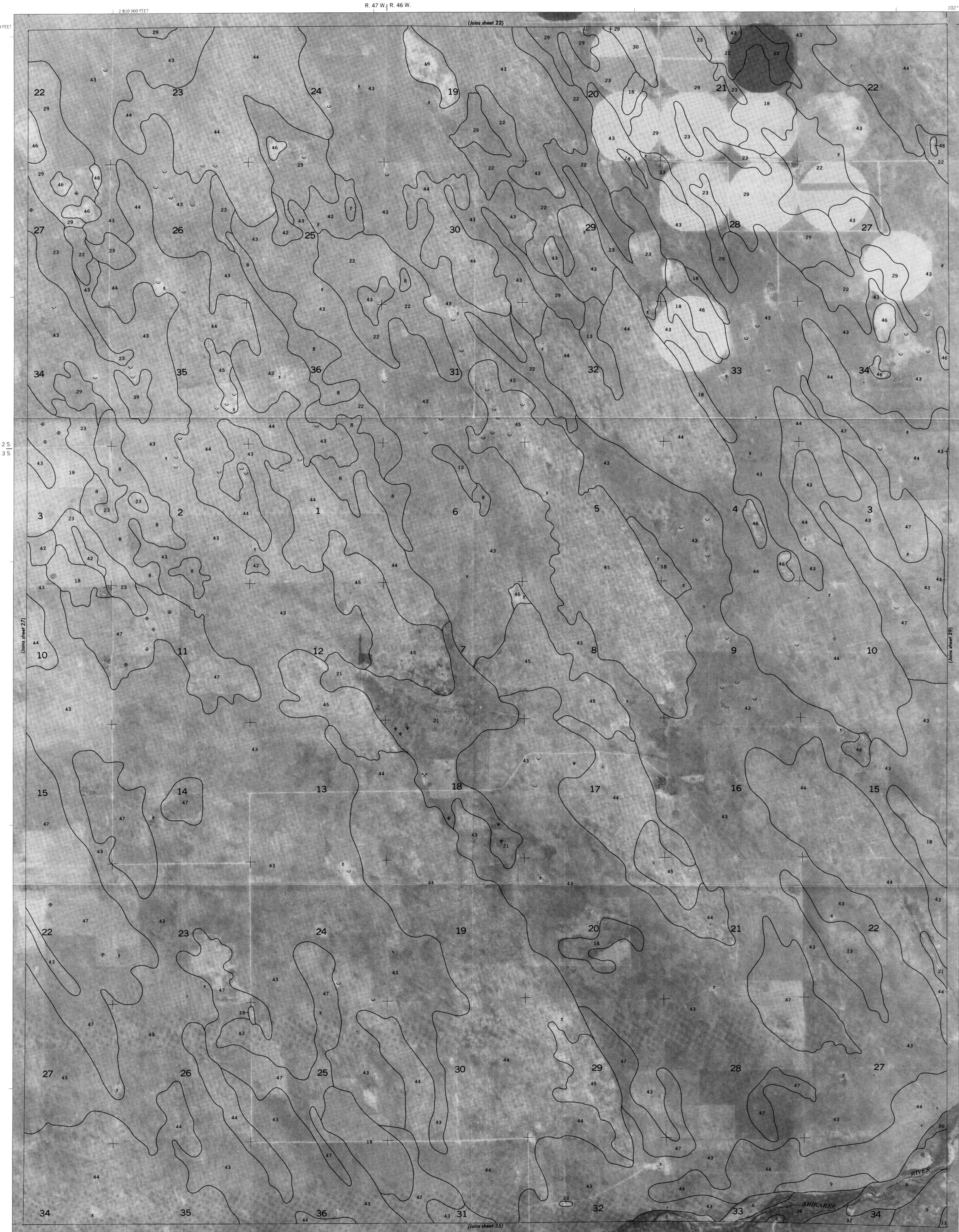
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ½ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 28
YUMA COUNTY, COLORADO
(ABARR SE QUADRANGLE)



Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

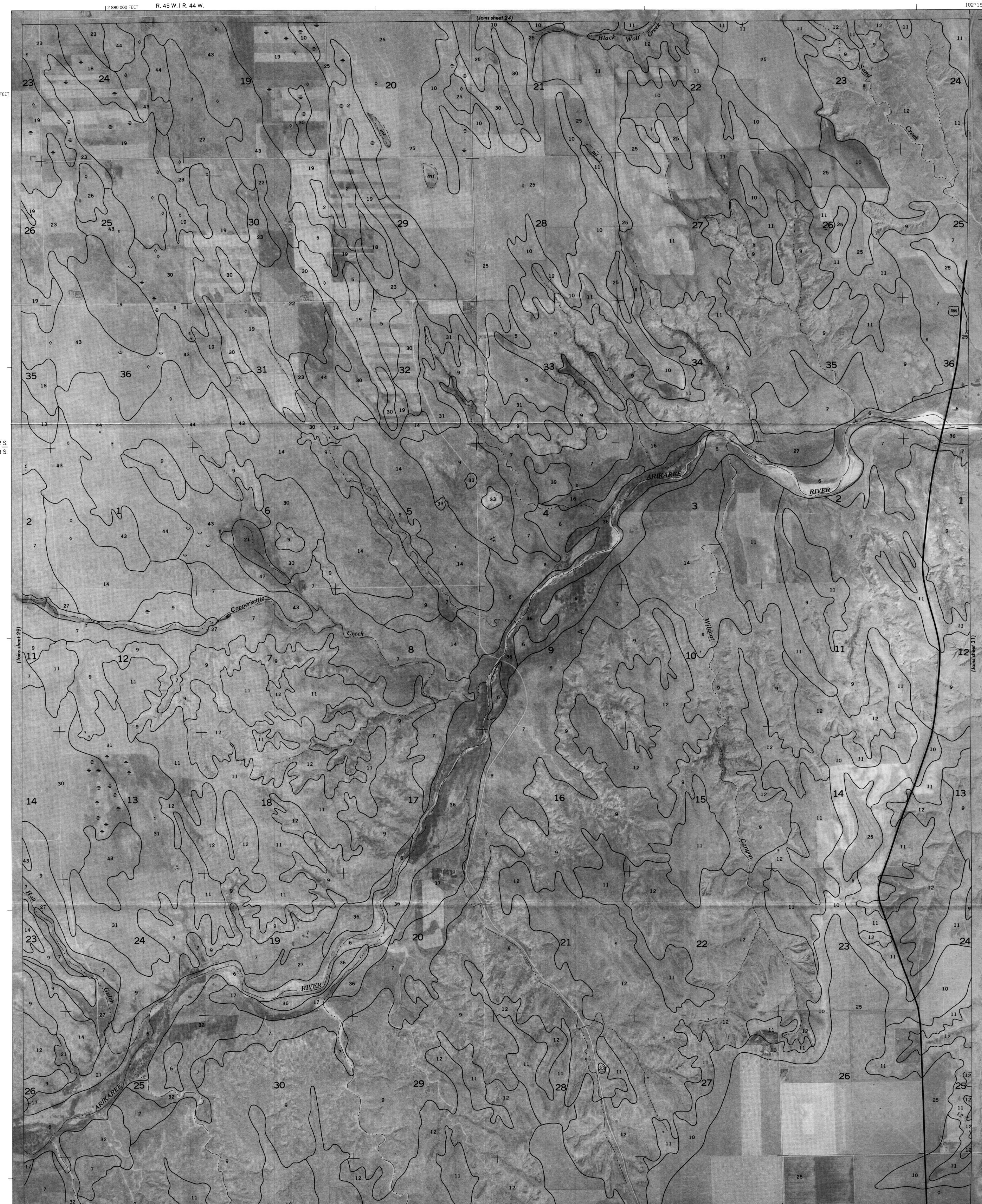
10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 30
YUMA COUNTY, COLORADO
(WILDCAT CANYON QUADRANGLE)



1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 32
YUMA COUNTY, COLORADO
(ARMEL QUADRANGLE)

1 ½ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

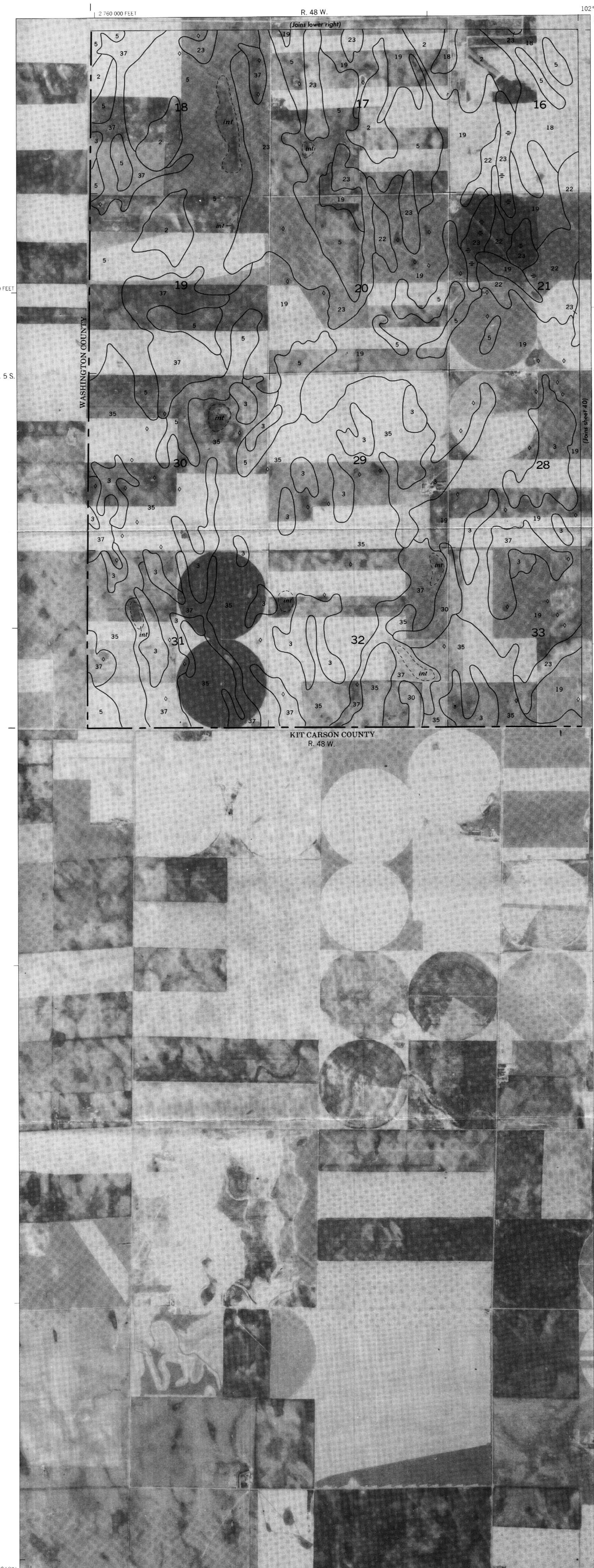
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 33
YUMA COUNTY, COLORADO
(COPE QUADRANGLE)

INSET



This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

R. 48 W. | R. 47 W.

2 780 000 FEET

102°37'30"
39°45'

T. 3 S.
T. 4 S.

160 000 FEET

T. 4 N.
T. 5 N.

120 000 FEET

39°37'30"
102°45'

R. 48 W. | R. 47 W.

2 810 000 FEET

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

10,000 foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

2 810 000 FEET   R. 47 W. | R. 46 W.   102°30′
39°45′

T. 3 S. / T. 4 S.

160 000 FEET

T. 4 S. / T. 5 S.

130 000 FEET

39°37′30″   102°37′30″   R. 47 W. | R. 46 W.   2 840 000 FEET

Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 37
YUMA COUNTY, COLORADO
(IDALIA QUADRANGLE)

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

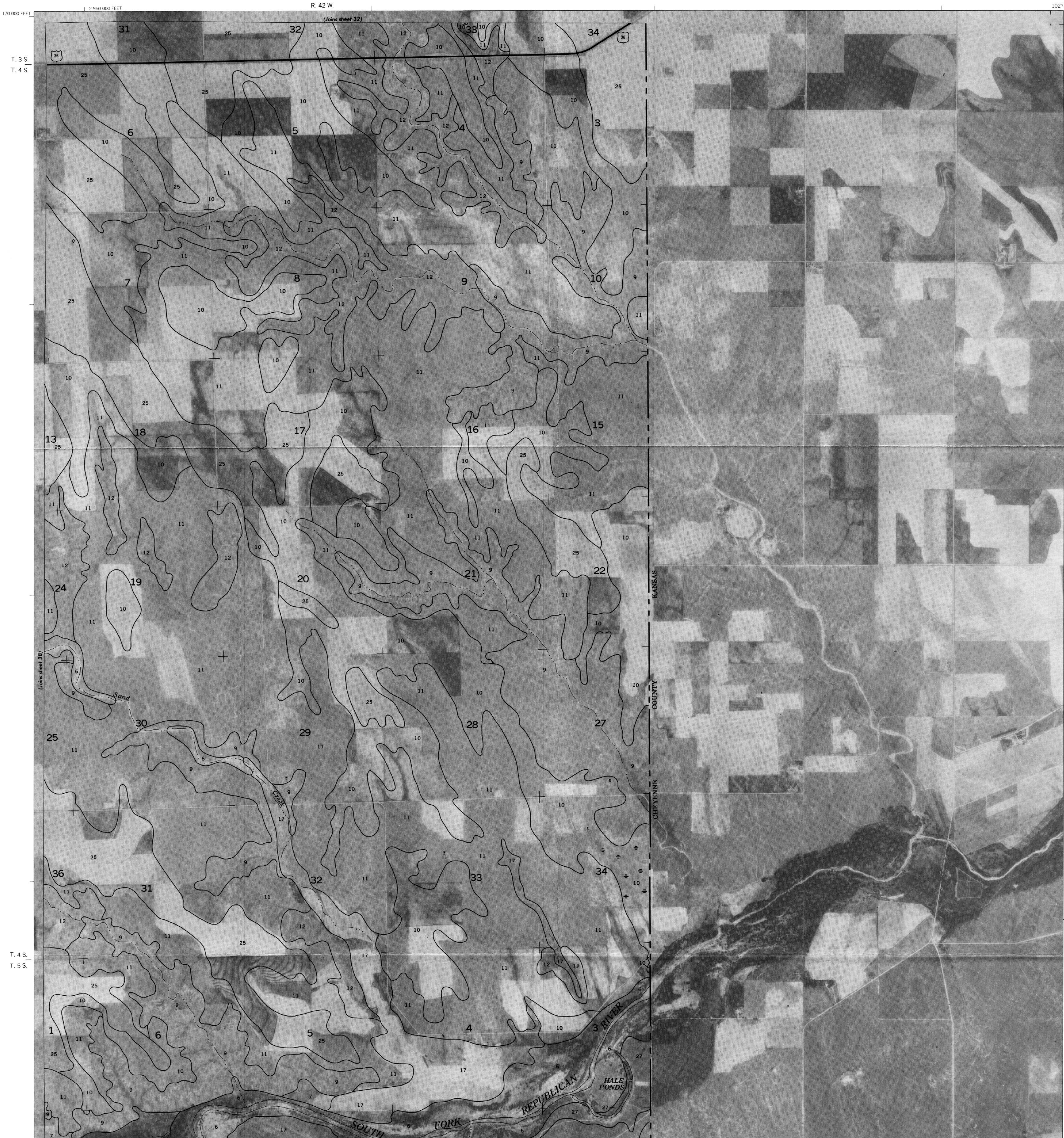
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 38
YUMA COUNTY, COLORADO
(BONNY RESERVOIR NORTH QUADRANGLE)

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

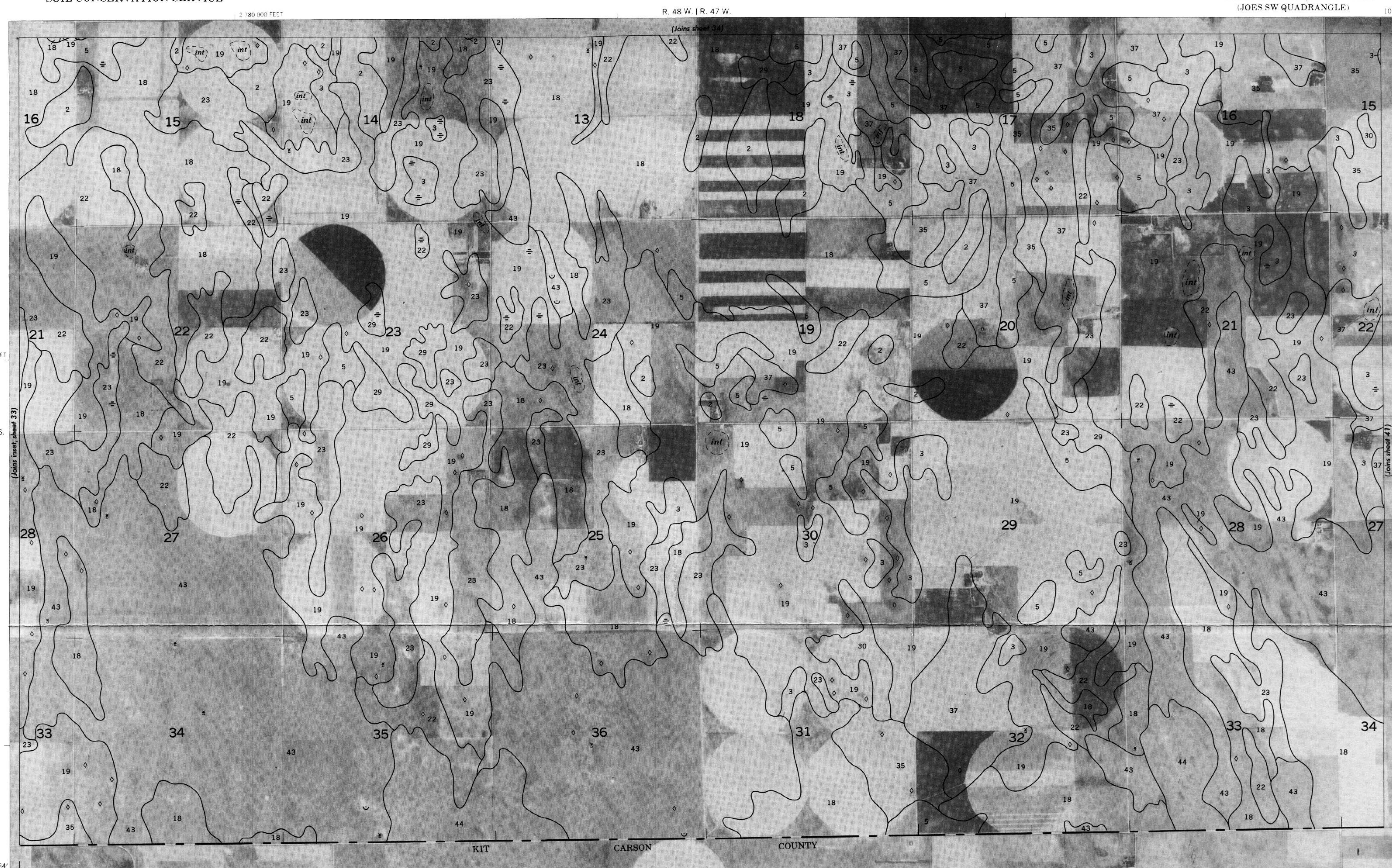
10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

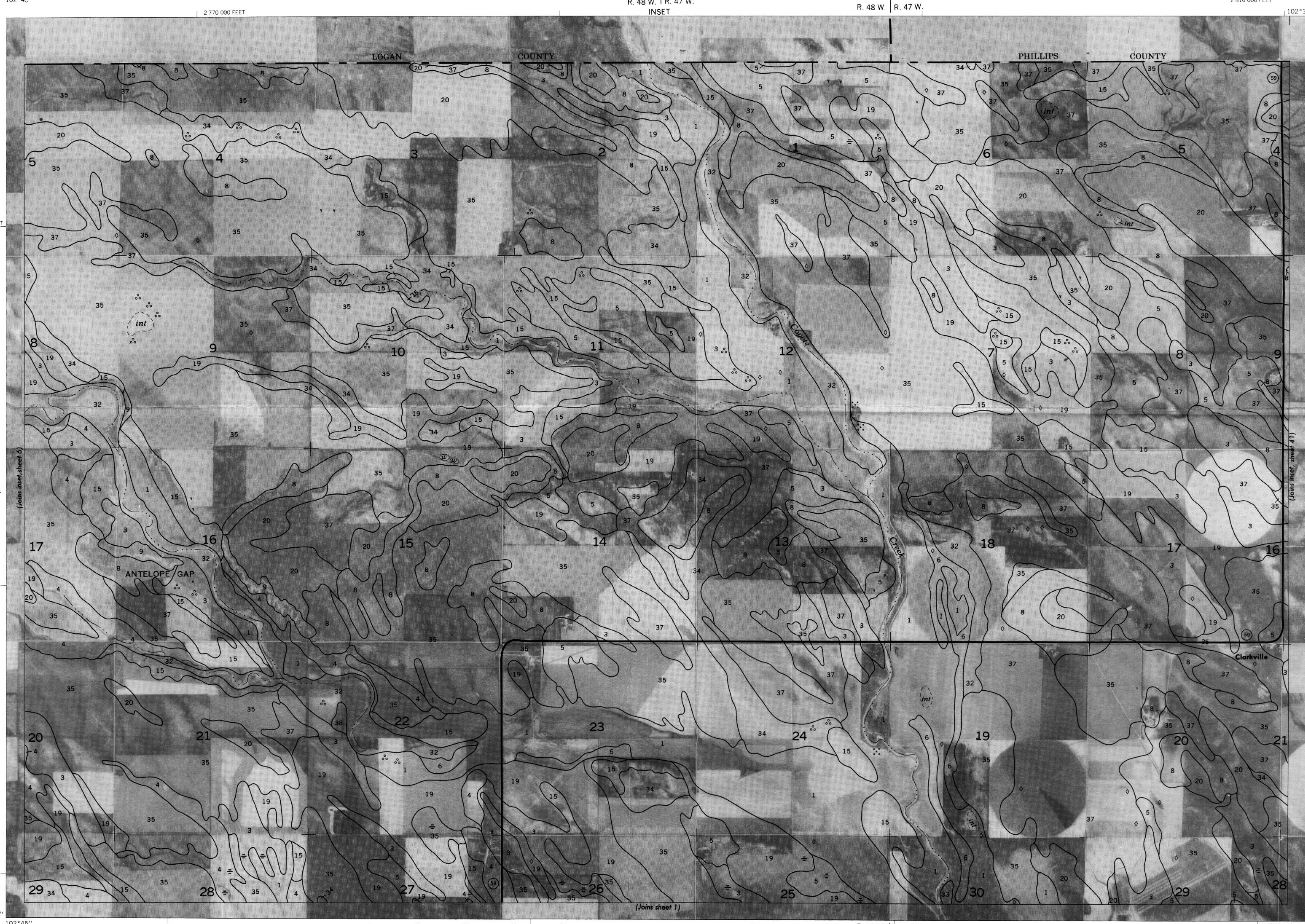


1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.





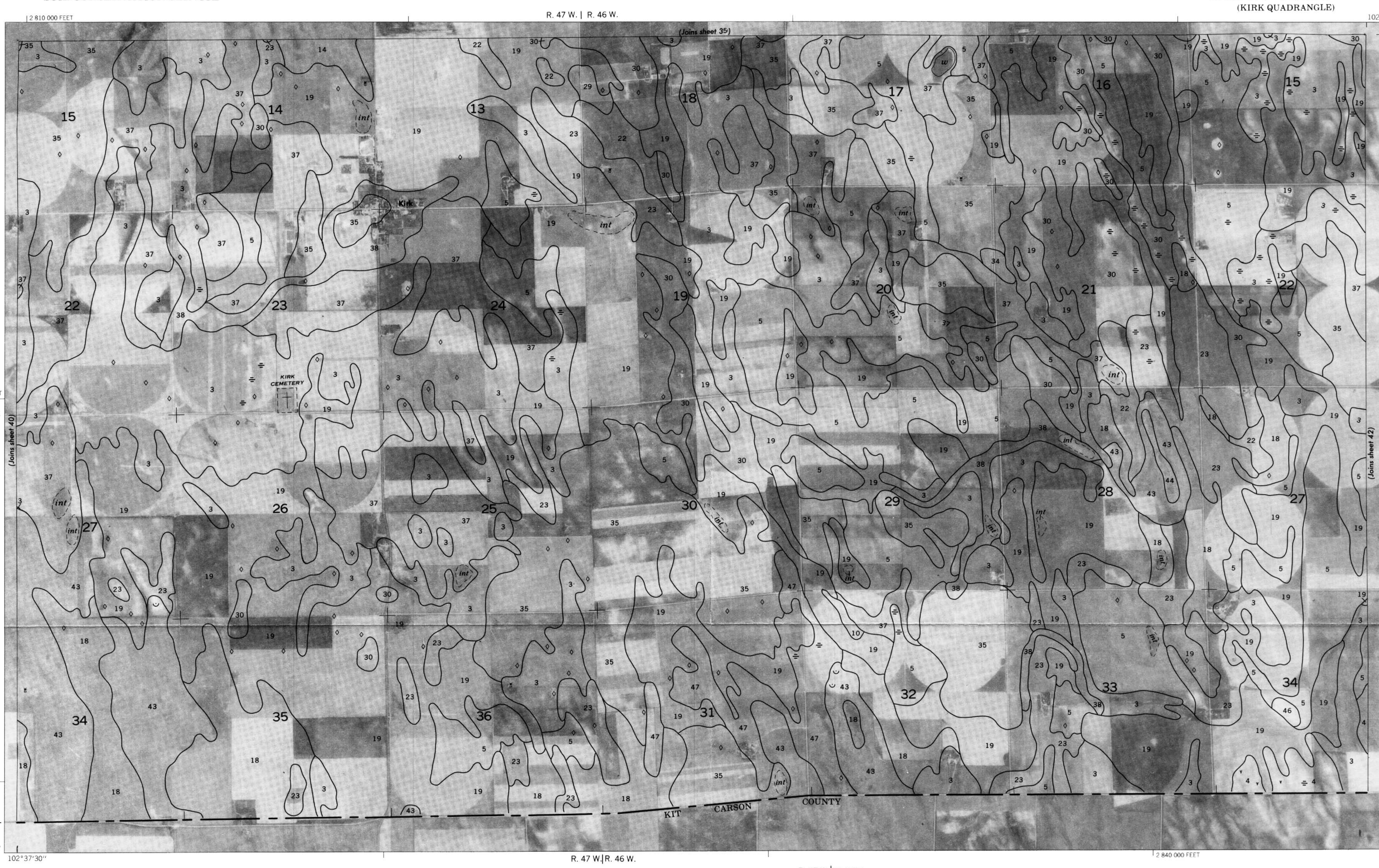
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000
R. 48 W. | R. 47 W.

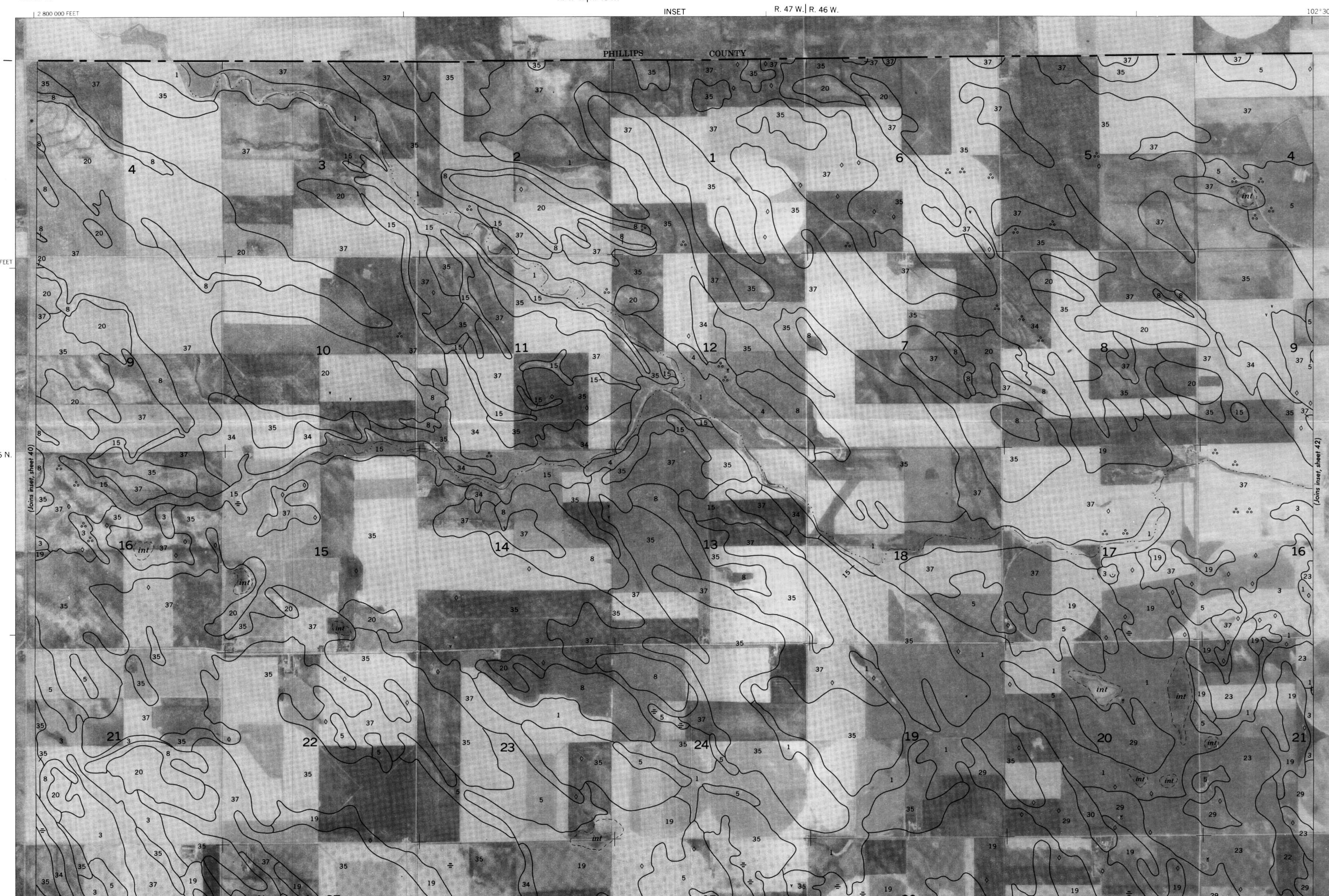
This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 41
YUMA COUNTY, COLORADO
(KIRK QUADRANGLE)



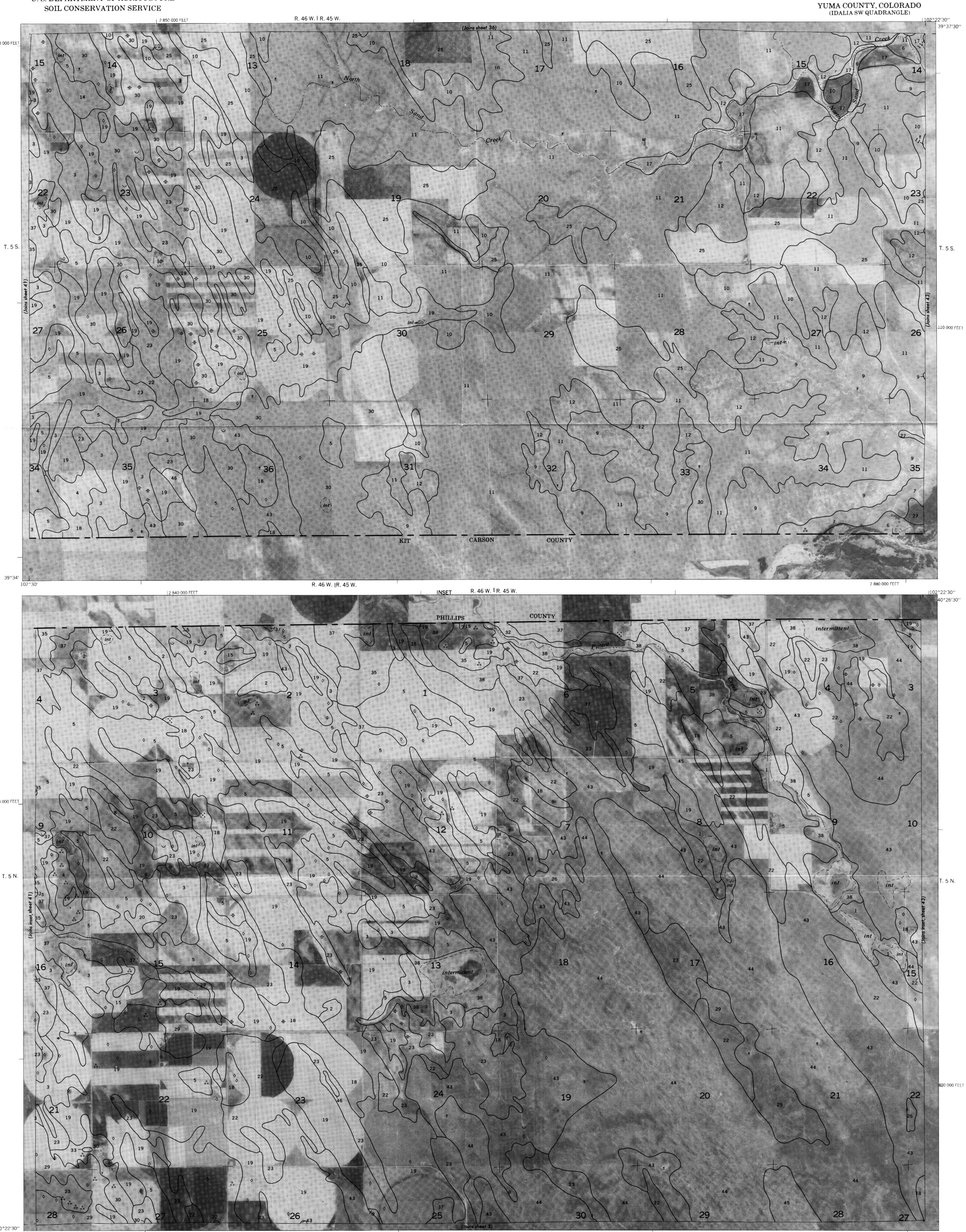


Scale 1:24 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.

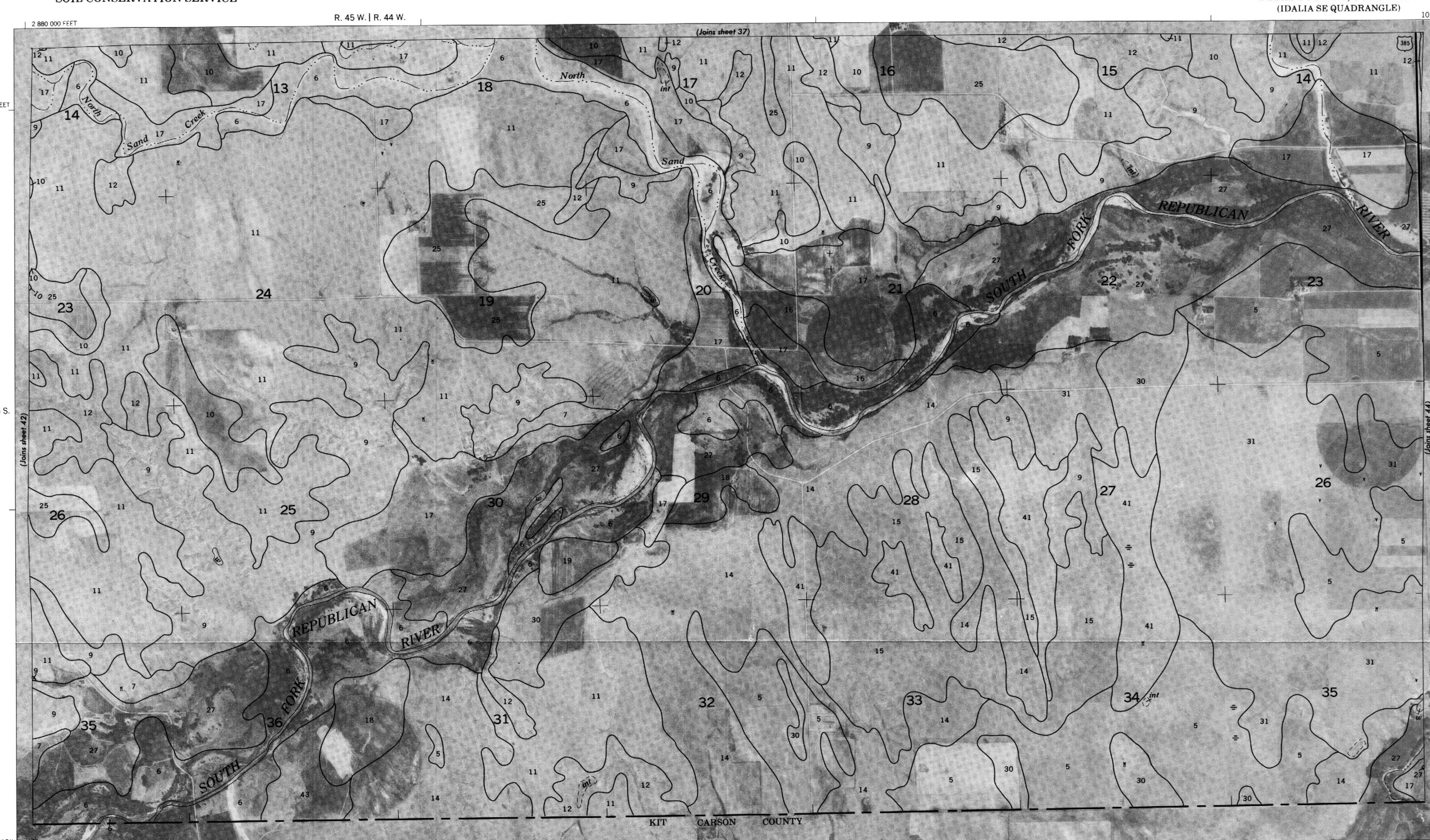
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

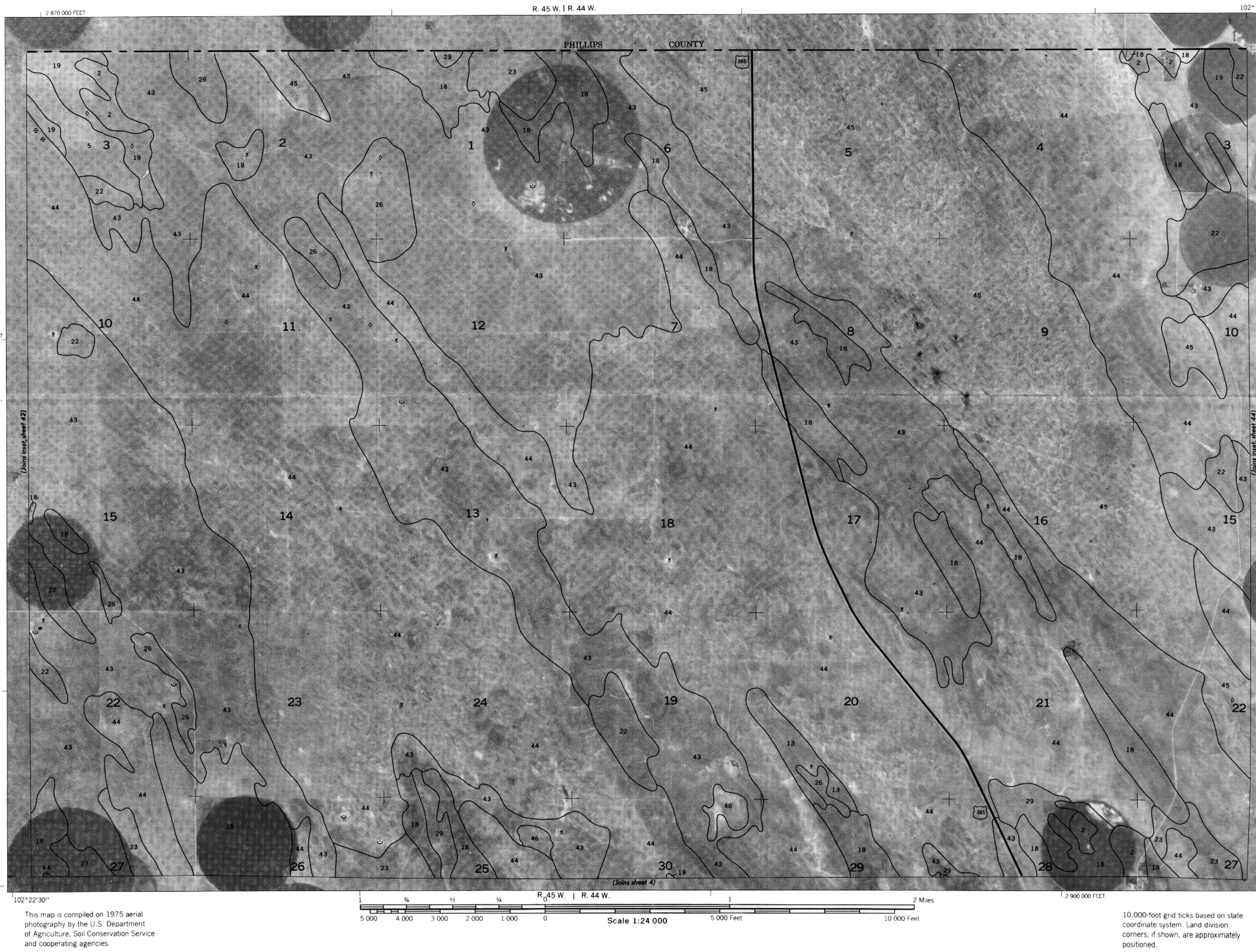


1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

10,000-foot grid ticks based on state coordinate system. Land division corners, if shown, are approximately positioned.





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1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

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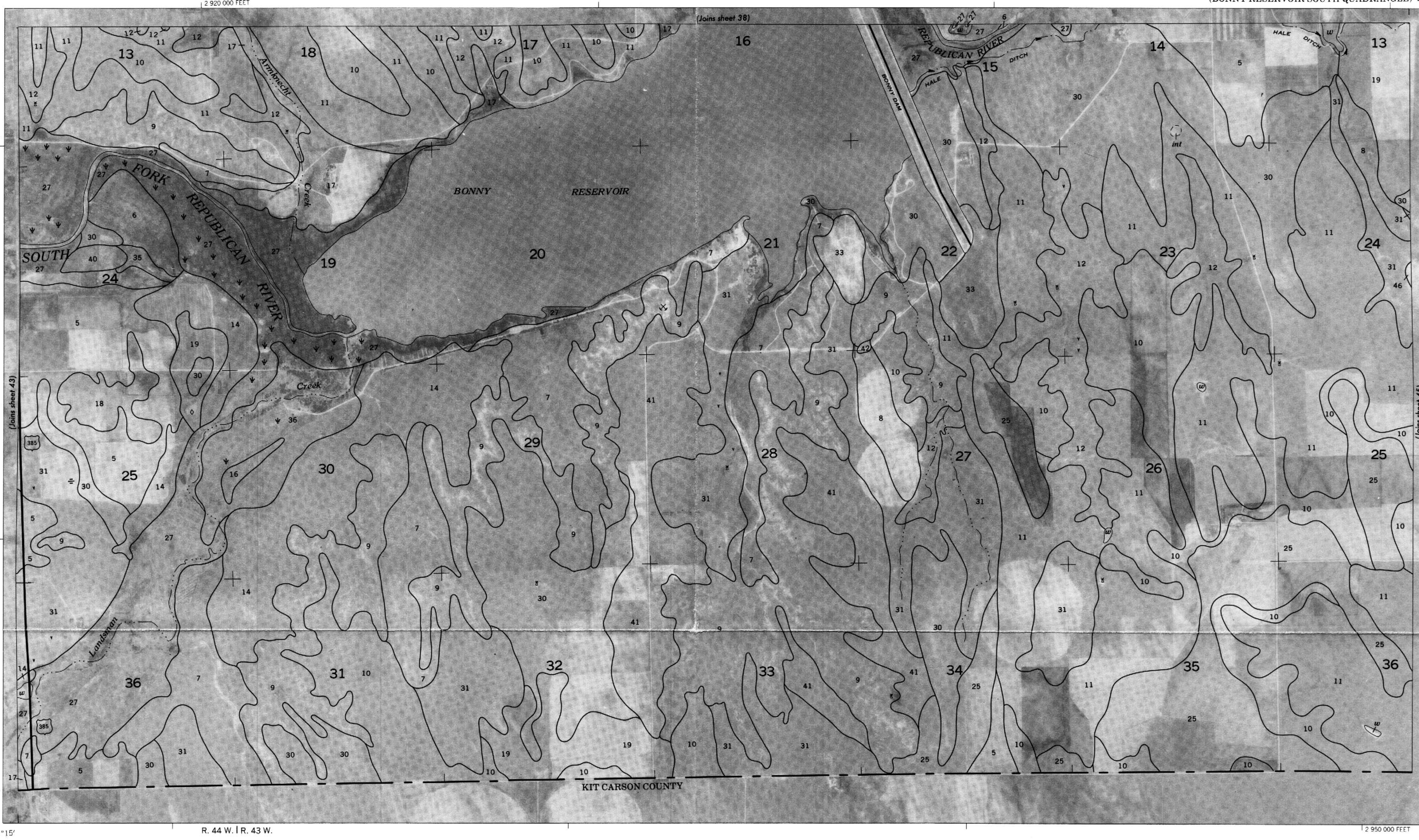

R. 44 W. | R. 42 W.
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
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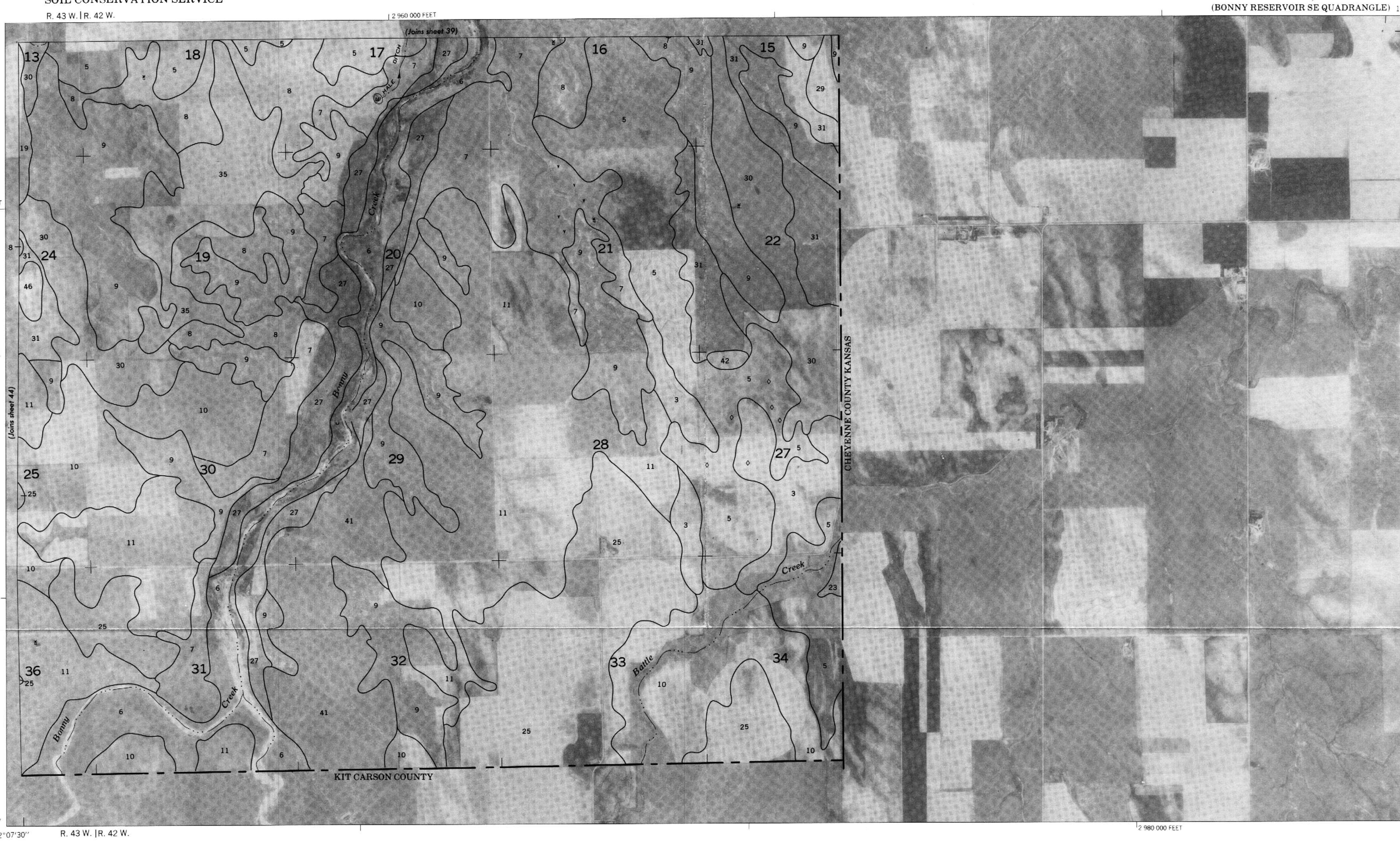
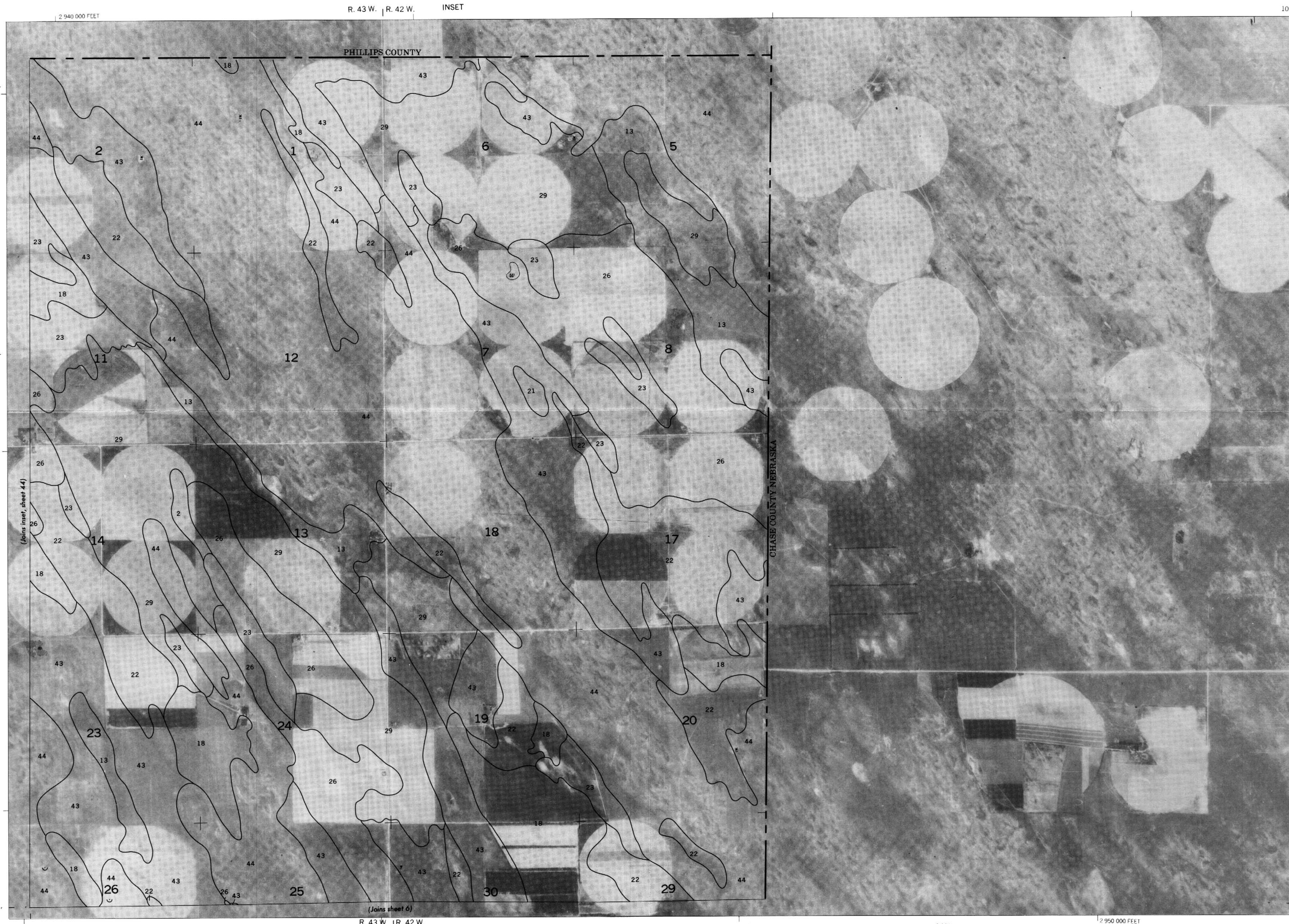
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 45
YUMA COUNTY, COLORADO
(BONNY RESERVOIR SE QUADRANGLE)





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